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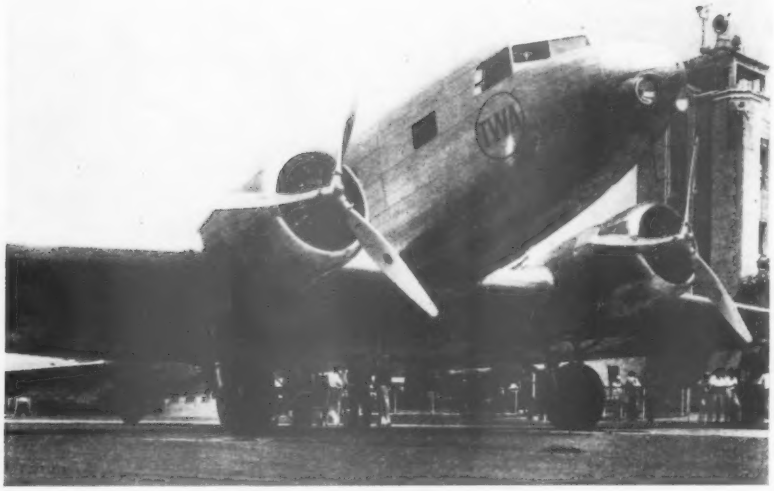
"Up-Gear" and "Down-Gear"

by
D. W. TOMLINSON



Loading passengers into a Douglas transport for an overnight trip across the continent. The plane is now "down-gear."

NINE tons! A TWA transport—duraluminum structure, steel, fuel, instruments, crew, passengers and cargo—rises gracefully into the air.

And, as the Captain of a ship at sea gives his orders from the bridge so does the Pilot of this most modern airliner give the command, "Up Gear." The Co-pilot acknowledges the order by repeating "Up Gear," and, when he has retracted the landing gear into the engine nacells and locked the hydraulic retracting system in neutral position, he reports to the Pilot, "The gear is up."

The time has come in aviation when the piloting of an airliner is as much of a responsibility as the command of a ship at sea. Taking an airplane into the air may be an exceedingly simple maneuver, or it may be a highly technical one. This depends upon the airplane; upon whether it is a light two-place 40 h.p. sport plane, or a 14-passenger, 215 m.p.h. airliner with supercharged engines, controllable pitch propellers, retractable landing gear, and two way radio telephone as well as a long wave receiver for Department of Commerce weather broadcasts and radio beams, as is found in the Douglas Transport.

A tremendous change has taken place in the technique of flying these large, fast transports. It is no longer a one-man job under any condition and it is no job for the push and pull pilot of yesterday. Your air-line pilot of today must combine the lore of airmanship learned through years of experience in flying through all kinds of weather and over every type of terrain, with technical knowledge and training of a high order. Let us look into the cockpit of one of these new transports through the eyes and mind of the pilot who will take the plane on a scheduled flight.

Before the engines are started, the pilot enters the cockpit. The ground crew has already plugged in the "Battery Cart" (or ground batteries which are used at terminals to save the plane's battery). The pilot throws the electrical switch to the position marked "Battery Cart." The electrical system of the plane is now alive. He throws a small switch marked "Electrical Instruments" to the "ON" position. Many instrument hands on the instrument panel simultaneously leap to true readings.

The pilot may now read the following instruments: Oil Temperature, Carburetor Air Temperature, Gasoline Tank Capacity Gauges, Outside Air Temperature and Cylinder Head Temperatures. Also, the appearance of two red lights, one over each fuel pressure gauge, advise him that there is no fuel pressure to the carburetors.

Quickly, the pilot checks the rest of the electrical circuits, controlled by a row of switches conveniently located in a panel above the windshield on the left side of the cockpit. These are: Instrument Panel Lights, Electrical Panel Lights, Cabin Lights, Running Lights, Warning Light, Compass Light, Seat Belt Sign Light, Air Speed Pilot Head, and Landing Lights. Assured that these circuits are in order, he is ready to start the engines.

Two kinds of gasoline are carried. 87 octane, the highest grade of aviation gasoline, is used for take-off, climb, and under any conditions where emergency full power may be required; 150 gallons of this gasoline are carried in the Auxiliary Tanks. The two main tanks, 180 gallons each, contain 80 octane gasoline, which is used for normal climb and cruising.

The first step in starting the engines is to turn the gasoline tank selector valve to auxiliary tanks "ON." The engine selector valve is turned to "Both" engines. This enables the pilot to cut the gasoline off from either or both of the engines without changing the tank valve. A hand-operated wobble pump, operated by the pilot, is used to build up fuel pressure to the carburetors. As the pressure increases to two pounds, the red lights go out and the pressure to each carburetor is indicated on the respective gauges.

The position of the hot and cold air controls to the carburetors must be on "cold." Oil temperature controls are normally placed on "hot" position until the engines are warm. The altitude controls to the carburetors must be set for full rich. Next, the pilot closes the master ignition switch, and, after assuring himself that the propellers are "clear," he closes the dual ignition switches to the left and right engines. The left engine is usually started first, as this engine carries the electrical generator. The starter selector switch is now put on "Left," the fuel pressure to the carburetor having been maintained for several minutes.

Now, the pilot fully opens, then closes and opens again the throttle to the engine he is about to start. This movement of the throttle operates a plunger pump in the large four-barrel (venturi) downdraft carburetor, and shoots a quantity of raw gasoline into the blower (supercharger) section of the engine.

At the start the throttle is placed just slightly ahead of the closed position. The electric starters are direct drive, so, as the pilot now pushes the starter button, the 300-lb., 3-bladed propeller begins to rotate at a good pace, and, after a revolution or two, the engine barks and starts. The pilot instantly releases the starter button and, if the engine appears to need further priming, he will work the throttle back and forth until the engine is idling smoothly at 500 to 800 revolutions per minute.

The starter selector switch is now

With the Airline Pilots

thrown to the right engine and the process repeated. The engine revolutions of both engines are gradually brought up to 1000-1200 until the oil temperature is up to 100 degrees Fahrenheit.

While the engines are warming up the pilot will utilize the time to check other details. He will look at both his compasses and see that deviation tables are in place. The automatic pilot is given a ground check. There should be about four inches of vacuum indicated on the gauge of the automatic pilot. This vacuum is produced by an engine-driven pump on each engine. One pump is sufficient, but two are carried as a safety factor. A two-way valve controls the source of supply. The pilot tries each pump to make sure both are working.

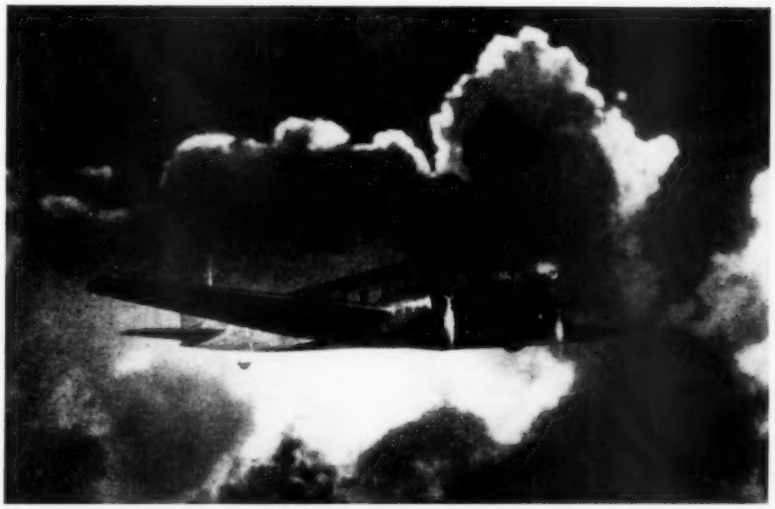
When the gyros are speeded up, these respective instruments are "caged" or neutralized with respect to the airplane itself and the reading of the directional gyro is set to correspond with the compass reading. The pilot will then hold the airplane controls in neutral, and, by turning the rudder, aileron and elevator adjustments of the automatic pilot they will then be synchronized in neutral with the respective controls.

Now, if the oil pressure in the system of the automatic pilot is up, 150 lbs. or more, the pilot throws his master automatic pilot control valve to "ON" and the airplane controls can then be moved only by the automatic pilot, unless the pilot himself wishes to "overpower" the hydraulic pressure of the automatic pilot.

Instead, he now turns the respective control knobs of the automatic pilot. The rudder control he moves both left and right, and, by watching his rudder pedals he can tell if the "iron mike" is functioning correctly. The same process is followed with the ailerons and elevators. Thus, before ever leaving the ground, a pilot may determine that his mechanical assistant is on the job and ready to do its trick at the controls when called upon.

As the engines warm up, the controllable pitch propellers are given a ground work out. This is just by way of making sure that nothing has become stuck or jammed. The propellers are always put in "low pitch" when landing and normally are left that way on the ground. A single lever controls both propellers. The pilot places it in the position for "high pitch," speeds up the engines to about 1400 rpm., and watches to see that the centrifugal action of the weights bring the blades into the full high-pitch position.

If it is cold weather it may take a minute or two to force the cold oil out of the propeller hub into the engine.



A Douglas plane, belonging to TWA is flying over the top of a storm—"up-gear."

When the high-pitch position has been reached by both propellers, the control lever is placed in "low-pitch" position. Now the normal oil pressure of both engines forces warm engine oil into the propeller hub, and causes a hydraulic piston to force the individual blades into low pitch. The procedure may be gone through several times in order to thoroughly limber up the controllable pitch mechanism. Always, the pilot makes a final check to be sure the propellers are in "low pitch" for take-off.

The engine instrument board is given careful scrutiny. The two altimeters (sensitive and non-sensitive), rate-of-climb indicator, and air-speed meter are observed to see that their ground readings are normal. The bank-and-turn indicator which has three sources of vacuum, is checked. It may be run in flight by the suction from a venturi outside the fuselage, or suction may be taken direct from the blower section of one of the engines, or from the engine-driven vacuum pump being used to operate the automatic pilot.

This vital instrument is always checked carefully by the pilot, because, if all the other gyro instruments should fail, he can still fly "on instruments," using the bank-and-turn indicator together with the compass, sensitive altimeter, rate-of-climb indicator and air-speed meter.

The radio is also tested before leaving the operating line when the engines are run up. In spite of the fact that the new type of antenna is a mere 35 feet or so of free wire trailing from the tail of the plane, dragging on the ground when the plane is on the ground, the radio may be used on the ground with a range of as much as 300 miles at times. The pilot will turn on both the "Receive" and "Transmit" switches for this test. He calls the adjacent ground station and asks for the correct time. This checks his two-way radio and gives him the exact time by which to set the airplane clock.

Time is as important to him as it is to a railroad engineer. Radio broadcasts of all kinds are timed meticulously. When this contact has been completed, the "Transmit" switch is turned off, the two-way voice control is turned down and the long wave Department of Commerce Beacon and Weather and Beacon volume control is turned on. Simultaneously the pilot sets the wave length of this receiver to that of the nearest Department of Commerce station. If all is well, he will hear the characteristic Airway Beacon signal for the quadrant in which the airport is situated, or a weather broadcast which may be in progress.

There are still things for the pilot to observe and check. It is important that the flaps, or "air brakes" be in the "UP" position for take-off. Their position is indicated by a tell tale on the instrument board. On the control pedestal in the center of the cockpit are three dials, indicating the position of the Flettner controls on the elevators, rudder and ailerons. These are used to trim the airplane. The setting of the elevator Flettner depends upon the load in the plane and its distribution. The rudder and aileron Flettners are normally set to zero, or neutral, except when flying the plane on one engine, or when all the gasoline has been used out of one wing tank.

After loading passengers and cargo, the pilot makes a final engine test just

before take-off. At the end of the runway he plans to use he faces the plane in position for take-off, places the tail-wheel lock in "locked" position so that the plane must roll absolutely straight, and, with the hydraulic brakes locked, he runs up each engine and tests the magnetos by grounding (cutting the switch) the left, then the right magneto, successively.

Assured that the engines are functioning perfectly, the pilot looks toward the field control tower to receive the signal to go. If a green signal light is pointed at him he is to take off. If the light is red, he must hold fast until the light changes to green. Some of the major airports supplement the red and green lights by radio. On these fields the pilot, after running up his engines, must receive his release over the radio.

Ready to go, the pilot brings the engine manifold pressure up to 34 in., releases his brakes, and, with his left hand on the controls, his right hand on the throttles, the plane begins to accelerate. The throttles are opened evenly until the allowable manifold pressure has been reached. No longer can throttles be shoved wide open. These are days of supercharged engines and to exceed set pressures in the distribution manifold would damage the engines. After the plane leaves the ground at about 60 m.p.h., the plane is held down; that is, it is not allowed to climb at once, but instead gains speed until 100 m.p.h. is reached. When air borne, the command "Up Gear" is given by the pilot and the flight really begins.

Prior to take-off, even before taking his seat in the cockpit of the plane at the hangar, the pilot has studied his weather conditions and generally planned his flight, which includes the theoretical determination of the drift angle on his course from wind aloft reports. Depending on the weather conditions and on the length of the flight, the climb to cruising altitude may be made in either of two ways. The more rapid climb is accomplished with the propellers in low pitch, at an air speed of about 110 m.p.h.

If climbing above clouds, rough air, or up to strong, favorable winds, this method may be the most desirable. On the other hand, if the air conditions are smooth, the weather clear, and the winds moderate or head-on, the most efficient climb is made at an indicated air speed of about 145 m.p.h., with the propellers in high pitch, which corresponds to high gear in an automobile. Of course, the rate of climb in this high-speed condition is only approximately a third of what it is in low pitch at low speed (1200 feet per minute at full power).

In this respect the plane may be likened to an automobile climbing a steep hill in low gear at low speed, or racing up a long, gentle grade at high speed. In any event, the plane is always cruised with the controllable pitch propellers in "high pitch,"—the airplane's hi-gear.

The pilot (left) discussing the latest weather reports and storm centers with the dispatcher before starting out on his transcontinental flight. Meteorology is a science of extreme importance to the commercial pilot.

The altitude at which a flight is made with a Douglas transport depends upon several factors, all of which come into play because of the increase in cruising speed enjoyed by this airplane with increase in altitude at which it is flown. It is virtually a substratosphere airplane in that the most ideal altitude at which it may be flown is around 16,000 feet,—too high for passengers except for short periods, and then only for very good reason.

First of all, the pilot considers passenger comfort, which is a matter of smooth air and moderate altitude. After that comes efficiency of operation with respect to ground speed and fuel economy. The major factors influencing this secondary consideration are length of the flight, wind conditions and cloud conditions.

These variables must be integrated by the pilot on a mathematical basis and adjusted by experience to find the best answer for each situation. The normal cruising strata for these modern transports is between 6,000 and 14,000 feet.

The throttles are no longer set by guess work. An exact relationship exists between horse-power output, engine manifold pressure, revolutions per minute, barometric pressure (altitude) and air temperature. As a result of very complete experimental flight test data, the speed of the airplane for any given revolutions per minute of the engines is known by the pilot at all altitudes, and for varying air temperatures.

All this information is condensed into a cruising chart, from which the pilot may readily determine the revolutions per minute at which to run his engines to obtain the desired speed and the percentage of full power of the engines which is being used to produce that speed.

So, at the cruising altitude which the pilot has chosen, he adjusts the speed of his engines (within set limits) to give the airplane the true air speed, which, under existing wind conditions, will bring the plane to the next stop at the scheduled time. This is truly scientific flying.

The engines must be synchronized so that each propeller revolves at exactly the same revolutions per minute as the other. This was formerly done by the pilot relying on his sense of sound to adjust the throttles until the beat of the propellers merged into a steady drone. Now, an instrument, with several lights arranged in a circle, tells the pilot which engine is running the fastest by the direction of rotation of the light flashes. When the engine speeds are exactly the same one light only remains lighted.

The pilot may now choose to turn the control of the airplane over to the automatic pilot. Let us follow the steps necessary to accomplish this. The directional gyro is again caged and the plane heading shown by it is set to correspond with the compass heading. Thus the compass and directional gyro show the same course. Actually, the directional gyro has a small "wander" and needs to be reset about every half hour, or allowance in the course reading must be made if the directional gyro is being used for steering. Next, the course card, immediately above the directional gyro card, which is set by the directional control knob on the

(*Continued on page* 390)

The N.A.C.A. Seaplane Model Tank

by S. R. WINTERS

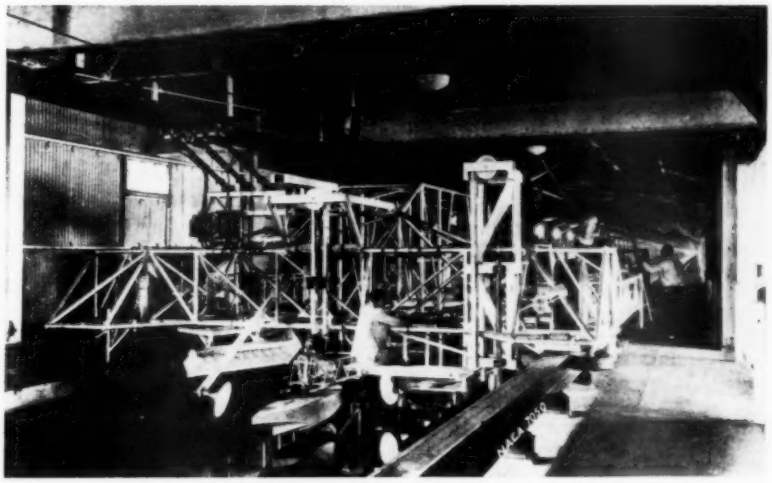
An informative yet non-technical article describing the experimental model tank employed by the National Advisory Committee on Aeronautics for testing and developing hulls for seaplanes and flying boats.

FORTY years before the development of the seaplane began, model towing basins were already in use. However they were then used for obtaining information concerning surface vessels of all types.

With the appearance of the seaplane it was quite natural to turn to these towing basins for aid in designing seaplane floats. Despite the valuable information gained therefrom it was readily found that tests of models of seaplane floats in such model basins were handicapped because of the relatively low speeds of the towing carriages.

In 1929, a survey made by the National Advisory Committee for Aeronautics showed that there was no such tank at all in the United States and they decided to undertake the construction of one. It was found that the accuracy and satisfaction drawn from the tests varied in accordance with the size of the model or, in other words, that the nearer the model came to full scale size and speed, the more trustworthy were the conclusions from tests.

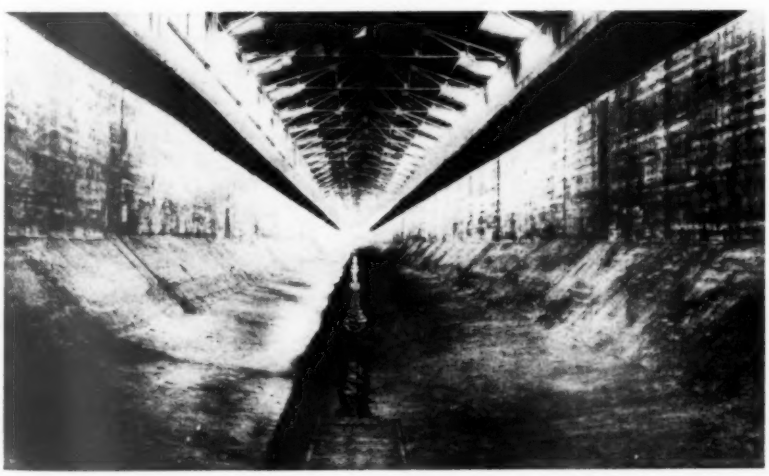
A large model meant that a large basin and towing carriage would also be needed. Such equipment would be expensive, but the N. A. C. A. decided to construct a tank which should represent an attempt to balance the various factors involved against one another. Construction was begun in 1930 and completed in 1931. The tank is located at Langley Field, Virginia, and extends about north and south along the west side of the southwest branch of Back River.



This is the model towing carriage of the N.A.C.A. testing tank. The model of a flying-boat hull is suspended directly in the center of the tank ready for testing.

The N. A. C. A. tank is of the Froude type. This means that the model which is being tested is towed through still water at successive constant speeds from a carriage spanning the tank. At each constant speed the towing pull is measured, the trim and the rise, or change of draft recorded, and, if the model is being towed at a fixed trim the moment required to hold it there is measured and recorded.

The reinforced concrete basin holding the water is 2,020 feet long, has a water surface 24 feet wide, the normal depth for water is 12 feet, and the length of this 12-foot depth portion is 1,980 feet. To assist in reducing the waves which the models cause and to reduce the width of the car by bringing the rails closer together, the sides of the tank are coved in above the water line.



Looking north through the empty basin of the N.A.C.A. testing plant.

The 4,000,000 gallons of salt water the tank contains are drawn from Back River by a centrifugal pump driven by an electric motor. About 40 hours are required to pump the water in or out. An annex at the south end of the basin contains the shop and offices, including the pumping plant and the electrical equipment such as motor generator set, switchboards, etc. for the supply of current to the carriage.

A simple building, mainly for the purpose of protecting the surface of the water from the effect of wind and weather, covers the whole tank. This shelter is 2,060 feet long and 28 feet wide and has a steel frame of ordinary construction with corrugated sheets of an asbestos-cement composition. The roof is supported by trusses and columns spaced at 20-foot centers. In the middle of each 20-foot bay and on each side and as high up as is feasible, a small window is located. Light diffusing glass is used to reduce the amount of direct sunlight falling on the water of the tank.

On examination of the rails on which the towing carriage runs, they are noted to be heavy H-beams, set with the web vertical. Cross ties, or chairs, made of short lengths of steel tie section support the rails. With staggered joints the rails are laid in 60-foot lengths. These joints are just butted with enough clearance to allow

the ends to meet at a temperature of about 80° F.

Every precaution is taken to endeavor to have the rails follow the curvature of the earth taken by the surface of the water. The rails are leveled to the same height above the water surface and the alinement of the east rail is made with extreme care. Leveling of the top surfaces of the rails is done by measuring from the surface of the water in the tank while it is perfectly still, using an electrical contact point on the extended spindle of a micrometer head.

From careful checking it appears that the rails are within 0.0015 inch of parallel to the water surface. The east rail, which is used to hold the car on the rails, is alined by means of a special transit and reference points placed in the concrete of the tank. Guide rails on the east rail only, bear on both sides of the web and keep the car in a straight line.

The towing car is constructed of carbon-steel tube; all joints are welded. To ascertain accuracy of alinement in the girders forming the car structure, ends of all tubes meeting at a joint were milled to fit compactly before welding; all welding was done with the structure in a huge jig. The gear cases are also of welded construction.

The car really consists of a center-line girder, two side girders, and two transverse girders. The center girder is deep enough to carry the dynamometer and persons also. The other girders are shallower and are proportioned only by the strength requirements and the necessity for securing other parts of the carriage.

There are four wheels on the car; they are fitted with high-speed bus or truck tires with smooth treads, and are known as pneumatic tires. The guide wheels on the east rail for the purpose of holding the car straight have grooved solid rubber tires of a medium soft composition.

Four electric motors of 75 horsepower each, tow the car; they can for short periods deliver 220 horsepower each. They are direct-current motors having two field windings. One field is excited by the armature current from one of the other motors; the other is excited separately. The wiring is set up so that the armature current from the front pair of motors goes through the field windings of the back of motors, and vice versa.

The speed of the car is changed by varying the voltage of the armature current; the shunt field current is held at a constant voltage. During acceleration, the increase of the armature current is controlled automatically to suit the rate of acceleration wanted; the change to constant speed conditions is also made automatically.

The current for propelling the car is supplied by four overhead trolley wires on which travel two armature trolleys and two field trolleys making two cir-

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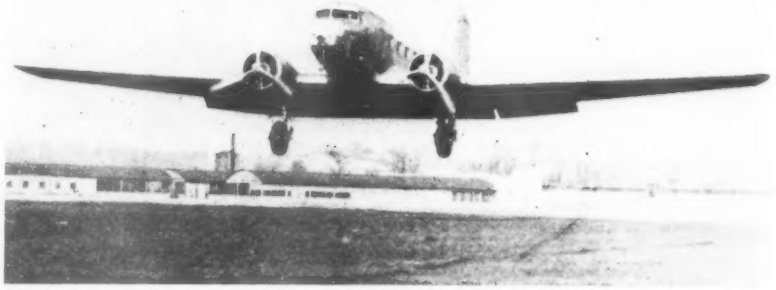
A Few Ultra Modern Improvements



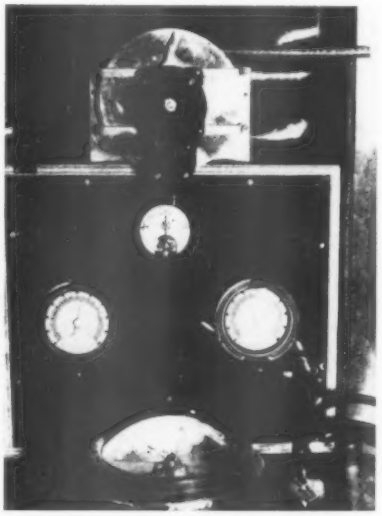
Making a landing with the flaps down.

THE year 1934 saw vast improvements in commercial aviation, particularly in "avigation" which is the recent name for aerial navigation. This year saw the crest of development in blind-flying technique, radio compass development, robot control and the improvement in speed range.

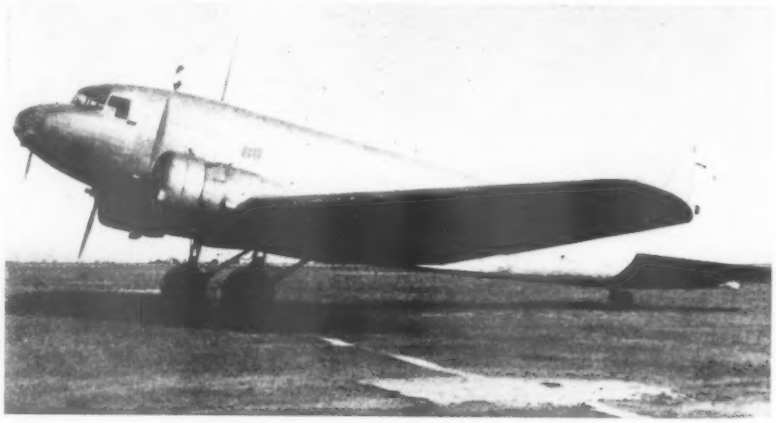
First, and in many senses the most important contribution to airplane design in that past year, is the introduction of flaps on the wings of commercial planes. By reason of the flaps, it is possible to land a very fast ship at a moderate ground speed and this is a matter of the greatest importance in modern aviation. The flap idea is nothing radically new but the application is very recent.

Next, aviation's worst enemy—the weather—has been licked to a notable extent. It is now possible to fly a ship and land it with certainty under conditions of zero visibility, and that is a big advance in no uncertain terms. Another wallop dealt to old man weather is the new appliance that eliminates icing of the wings. Ice, in the old days, was usually accompanied by a sudden descent but ice no longer holds its old terrors.

But what appeals to the imaginative brain are the many new applications of radio to aerial navigation. First, the guiding radio beam that unfailingly directs the airplanes to their destination with all the certainty of a cowpath. Second, we have a direct application of the "robot" idea which was so successfully demonstrated. In short, by means of radio, it is possible to accurately direct a ship in flight to a given destination from the ground.



The mechanical brain of the robot ship.



Here's the robot mystery ship that flew without help.

The U. S. Military Air Trophies

This interesting article, taken from the *Air Corps News Letter*, describes the four major awards open to the personnel of the U. S. Army Air Corps. These trophies are awarded for various outstanding feats, ranging from air-race victories to self-sacrificing heroism. Drawings by Frank Dunnington, Information Division, O.C.A.C.

THE first Army aviation Trophy, the Mackay Trophy was tendered in 1912 by Mr. Clarence H. Mackay to the Aero Club of America for award by the War Department annually to the officer or officers making the most meritorious flight of the year. The National Aeronautic Association, successor of the Aero Club of America, is the present custodian of this Trophy.

The next Trophy to make its bow to Army flyers was the one donated by former General William Mitchell, of the Air Service, in memory of John L. Mitchell, his brother, who was killed in action during the World War. The contest for this Trophy is a strictly military event for pilots of the First Pursuit Group of the Army Air Corps, and the winner retains it in his possession until the victor of the next year's contest is announced.

The Cheney Award, bestowed annually for acts of valor or self-sacrifice.

Thus far, ten contests have been staged, the first in 1922 during the Air Races held at Detroit, Mich., when the winner, Lieut. D. F. Stace, averaged a speed of 148 miles per hour. There were six competitors in this event, all piloting the MB-3 airplane.

The following year, during the International Air Races at St. Louis, Mo., the late Captain Burt F. Skeel carried off the honors, averaging a speed of 156 miles per hour.

Up to last year, the high speed record for this annual classic was held by the late Lieut. Cyrus Bettis, who in 1924, during the International Air Races at Dayton, Ohio, averaged a speed of 175.43 miles per hour.

In 1925, Lieut. Thomas K. Matthews won the Trophy with an average speed of 161.5 miles per hour. The race was held at Mitchel Field, N. Y., and the winner piloted a Curtiss PW-8 Pursuit plane.

In 1926, when the International Races were held at Philadelphia, Lieut.

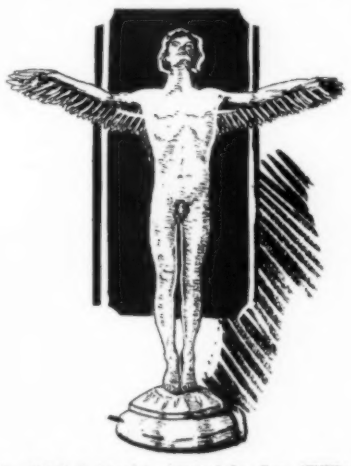
The Mackay Trophy awarded annually for the most meritorious flight of the year.

L. G. Ellicott, in a Curtiss P-1 Pursuit, averaged 160.45 miles per hour, and he held the Trophy for one year, relinquishing it to the late First Lieut. Irvin A. Woodring, who on October 12, 1927, at Fairfield, Ohio, when the Mitchel Trophy Race was one of the features incident to the dedication of Wright Field, averaged a speed of 158.968 miles per hour.

Fifteen P-1 Pursuit planes entered the Race, and there was but one minute and 23 seconds difference in the time of the first and the last plane.

Lieut. B. H. Lawson won the 1928 contest, which was held during the International Air Races at Los Angeles, Calif., his average speed being 154.743 miles per hour.

At Cleveland, Ohio, in 1929, the locale of the International Air Races that year, Lieut. Paul B. Wurtsmith was the winner of the Trophy, averaging 152.17 miles per hour.



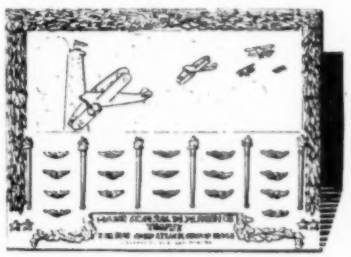
The Mitchell Trophy, donated by Gen. William Michell in memory of his brother who was killed during the World War.

In 1930 the Mitchell Trophy Race was held at the home station of the First Pursuit Group—Selfridge Field—and 2nd Lieut. Louis A. Vaupre, winner of the contest, averaged 146.7 miles per hour.

No contest was held during the years 1931, 1932 and 1933, but last Fall, when the race was again held at Selfridge Field, Captain Fred C. Nelson eclipsed all speed records previously attained in the contests for this Trophy. As a matter of fact, this was the case with all the participants in the 1934 event. Captain Nelson averaged a speed of 216.832 miles per hour.

* * *

THE first competition for the General Mason M. Patrick Trophy was held during the Air Races at Los Angeles, Calif., in September, 1928. This Trophy was donated by the Hon. F. Trubee Davison, former Assistant Secretary of War for Aviation, as a perpetual memorial to General Patrick upon the latter's retirement as Chief of the Air Corps. Under the provisions of the gift, it was to be competed for annually by the commissioned pilots of the 3rd Attack Group.



The Patrick Trophy, awarded annually to the commissioned pilots of the 3rd Attack Group.

This Trophy is a beautiful bronze plaque, 18 inches wide and 24 inches long. It is mounted on a piece of ebony. The upper half of the Trophy depicts a scene from the race. Planes are shown approaching, from the right, and a pylon at the extreme left. The lower half of the Trophy has been reserved for the purpose of recording the names of the winners from year to year.

Seventeen pairs of wings are divided into five columns; the two outer columns have four wings each, while the three inner columns have three wings each. The columns are separated from each other by lighted torches. Each year the winner's name is engraved

above one of the wings. At the base of the plaque is the following inscription:

Major General M. M. Patrick
For the Third Attack Group Race
Presented by F. Trubee Davison

Twelve pilots of the 3rd Attack Group participated in the first contest, all piloting the standard A-3 Attack plane, powered with the Curtiss D-12 engine, and the winner, Lieut. G. R. Acheson, averaged a speed of 139.525 miles per hour.

In 1929, when the Air Races were held at Cleveland, Ohio, 13 pilots of the 3rd Attack Group entered the competition. They piloted the identical type airplane flown the year before, but the speeds attained were considerably improved.

The contest for the Trophy in 1930 was held at Fort Crockett, Galveston, Texas, the home station of the 3rd Attack Group. Nineteen pilots of the Group participated, flying A-3B planes. The winner, Lieut. L. C. Westley, averaged a speed of 149.12 miles per hour over six laps of a 10-mile triangular course, or a total of 60 miles.

First Lieut. Don W. Mayhue won the 1931 contest, which was also held at Fort Crockett. His average speed was 142.59 miles per hour. No contests for the Trophy have been held since 1931.

* * *

THE Cheney Award was established in memory of 1st Lieut. William H. Cheney, Air Service, who was killed in an air collision at Foggia, Italy, January 20, 1918. The donors of this award are Mrs. Mary L. C. Schofield, Peterboro, N. H., and Mrs. Ruth Cheney Streeter, of Morristown, N. J., the mother and sister, respectively, of Lieut. Cheney, who have jointly set aside a trust fund of $10,000, the interest accruing therefrom to be used to make up the cash award.

It is to be bestowed annually by the Chief of the Air Corps for an act of valor or of extreme fortitude or self-sacrifice in a humanitarian interest which shall have been performed in connection with aircraft, but said act need not necessarily be of a military nature.

Those eligible to receive the Award are officers and enlisted men of the Air Corps, Regular Army; officers and enlisted men of the Air Reserve, and the widow or next of kin in the event of a posthumous award. Announcement of this award is made on January 20th of each year, that date being the anniversary of Lieut. Cheney's death.

A die of suitable design has been made, and bronze plaques are struck off each year the award is made, engraved with the name of the recipient.

An engraved certificate, describing the meritorious act performed, is also given the recipient, together with a sum of money, usually $500, the income derived from the trust fund after the

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The Mother of Marine Aircraft and Carriers

Here we have the long-boat with the balloon basket just above it which was quite a modern improvement in Civil War days.

AWAY back in the Civil War days in this country, many attempts were made at utilizing the balloon in warfare, and some of these attempts were surprisingly successful in spite of the crude apparatus then employed. It is interesting to note that Count Zeppelin himself learned much about aerial navigation while he was associated with the Federal Army during the Civil War.

The above photograph has much interest because it shows the first attempt at operating a balloon over water in connection with a boat hull, and as shown, the boat is designed to act as a landing and take-off platform for the balloon above it. By the employment of this boat, observers could embark and disembark from the balloon basket above the boat. The picture therefore shows the first elementary aircraft carrier ever in service. We are indebted to the U. S. Signal Corps for this old photograph.

Just What Happens When a Bomb Strikes

WHEN aerial bombing first came into being, during the World War, it was in a very primitive state and the effect of bombing raids was only known from the bombardment of buildings, trenches and other ground targets. There was no opportunity, during the war, for determing just what effect the bombs would have upon warships because the warships were not actively engaged to any extent at this time.

Shortly after the war, however, extensive bombing experiments were made by the U. S. Army bombers on a number of old and obsolete battleships. The ships were placed at anchor, and the mission of the bombers was not only to bomb these ships but also to locate them from dispatches sent by the command. Many of the raids were unusually successful and the aim of the bombers was highly accurate.

The accompanying photograph, by courtesy of the U. S. Army Air Corps, shows a direct hit by a bomb on the deck of one of these ships.

This bomb broke down the superstructure of the ship.

An Anti-Torque Prop Drive

by JESSE W. BRODEY

A novel means of driving propellers by a single engine in such a manner as to counter-balance the engine torque. This highly ingenious method avoids the use of gears.

BECAUSE that brand of man had not been seen around for so long a time, it seemed that he was extinct. But, nevertheless, there he was, a "bicycle-shop scientist," climbing down out of the open cockpit of his queer monoplane.

You must remember the Wrights, Curtiss, and Bleriot. They were all self-made scientists, experimenting in out-of-the-way places, in machine shops and make-shift laboratories. Not equipped with knowledge gained by academic training, but rather in the school of "Trial and Error," they perfected and introduced superb improvements for the world's means of transportation. Through perspicacious observation of the phenomena about them, salted with good old commonsense, they first reached various hypotheses which they then proceeded to prove and utilize mechanically. To them, this was a wonderful hobby.

Today, Charley L. Brown, typical of the species, flits around the airports of the Southwest. A Rushville, Missouri, oil jobber, his hobby is aviation but, unlike most other modern sportsman pilots, he builds his own ships instead of purchasing them and equips them with amazingly novel improvements of his own invention.

For instance the small open cockpit job he now flies was built by Brown almost entirely from raw materials, cruises at 125 miles per hour, and boasts an engine which completely eliminates torque, incidentally doing away with most of the vibration and propeller noise and giving without gears a more efficient propeller speed in ratio to the motor speed.

According to one of the fundamental physical laws of motion, every action has a reaction. As you know, on present type airplanes with the motor mounted stationary in the frame, the motor has a tendency to spin the airplane on its longitudinal axis in the opposite direction to that in which the propeller is being driven.

The propellers revolve in opposite directions, thus neutralizing the torque or over-turning effect of the engine. The limitation of the torque contributes much to the stability and control of the plane as well as to its efficiency.

Brown's novel motor is mounted in a hollow steel tube carried by two ball-bearings and is free to revolve. It absorbs the torque itself without transferring it to the ship. No power, however, is lost by virtue of the fact that a second propeller, with opposite pitch to the front, is part of the rotatable body of the motor and torsion turns this second propeller.

The effect of the arrangement is remarkable as proven in tests made during actual flights. Because of the suction created by the second propeller behind the first, the flutter has been to all appearances dispelled and because the speed of the motor is divided between the two propellers, each propeller speed is slower in ratio to the motor speed with resultant efficiency gained without any gearing arrangement.

But, most important of all, is the fact that the invention brings the dream of strong fast flivver planes nearer realization by permitting the use of heavier motors than are at present possible on light ships. It hardly is necessary to explain that the lightness of a ship today limits the size of its power plant.

If there is excessive horsepower, the vibration creates a terrific strain on the frame, and the torque is apt to spin the airplane itself as well as the propeller if sufficient forward speed and wing leverage could not be maintained to counteract the torque.

With Brown's motor, first of all, because vibration is enormously reduced, there need be no fear of a heavy motor straining its ship structure to the point where it takes off on its own! Secondly, because there is no torsional twist, there is no danger of spinning either in horizontal flight or vertical descent, no matter how powerful the motor.

Previous attempts at eliminating propeller torque involved planetary gearing and other mechanical complications of a like nature that made the idea impractical. The idea of torque neutralization is by no means new but Mr. Brown's solution seems to be the most practical yet devised.

Rear view of the anti-torque propeller drive.

The New V-100 Corsair Junior

This is the latest contribution of the Chance Vought Corporation to military aviation. The scale drawing of the new Corsair Junior will be found on the opposite page.

THERE is a marked tendency toward the adoption of the all-purpose military plane by the major nations as well as the smaller countries whose funds are limited. England, France and Italy have all developed planes of this same general type which are very effective and economical to operate.

A NEW model of the V-100 "Corsair Junior" has just been announced by the Chance Vought Corporation, East Hartford, Connecticut.

This is a two-seater light military airplane similar to the standard V-90 Corsair in general appearance, type of construction, and flying qualities, but smaller in size, lighter in weight, and lower in price.

The Corsair Junior is particularly designed for light military operations, its normal equipment including a fixed gun installation, flexible gun installation and provision for the ready installation of standard bomb racks under the wings. In addition it may be equipped with aerial camera, radio, camera gun, apparatus for blind flying, and other equipment for special military missions.

It is, therefore, adaptable to function as an observation, scouting, bombing, or attack type airplane. Moreover, this functional versatility of the V-100, combined with its low cost and excellent flying qualities, make it ideally suited as a general-purpose trainer.

Side elevation of the new Corsair Junior, type V-100 which retains many distinctive Corsair characteristics but on a small scale.

All of the useful load installations are patterned after similar installations in the standard two-seater Corsair, which in themselves are based on thousands of hours of actual operating experience. All of this equipment may be readily installed or removed, so the Corsair Junior may be quickly made ready to perform any of its many functions.

Of particular interest is the new flexible gun mount that has just been developed by the Vought design staff. It is of the combined post and track type, extremely simple and rugged in design, and permitting ready movement of the gun to any firing position. Its use in the V-100 Corsair Junior eliminates the cumbersome and heavy Scarff ring, and makes possible a much cleaner and more compact rear cockpit design.

The airplane has been subjected to an exhaustive series of actual flight tests, flown by pilots ranging in ability from highly skilled test pilots to students with a very limited amount of flying experience. Without exception, they reported that the airplane was easy and comfortable to fly, that its behavior was normal in take-off, straight flying, and landing and that it performed all maneuvers easily and with an ample reserve of power.

Structurally, the Corsair Junior is similar to the well-proven standard Corsair construction, but simplified to reduce cost and weight. The wings are of wood, fabric covered, with straight un-routed spruce spars and simple wooden ribs. The tail unit is constructed of welded chrome-molybdenum steel tubing, fabric covered, and is identical in design with that furnished on many Corsairs for the U. S. Navy.

A welded steel-tube fuselage is employed, with quickly detachable metal cowling forward of the cockpits and a newly-developed type of removable fairing aft of the cockpits, making it possible to lay bare the entire fuselage for overhaul, without the necessity of recovering.

The landing-gear is the same rugged oleo-spring type that has been used on all recent Corsairs, and is interchangeable with a single-float seaplane gear. A standard swivelling oleo tail

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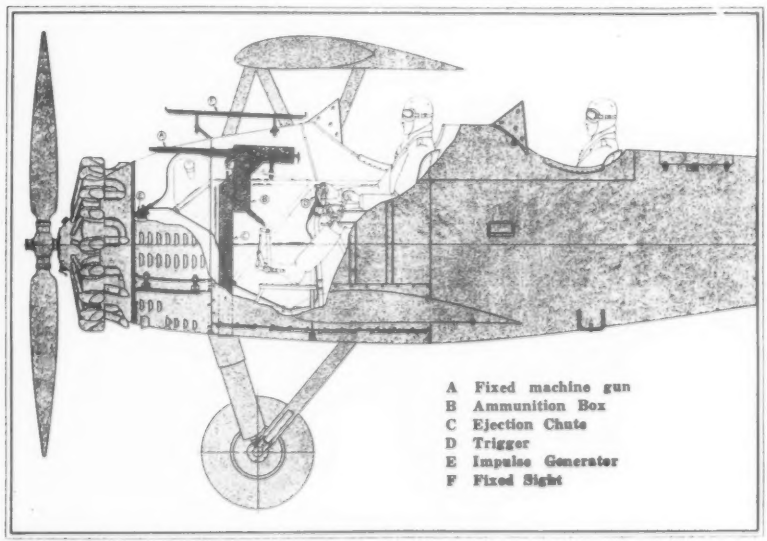
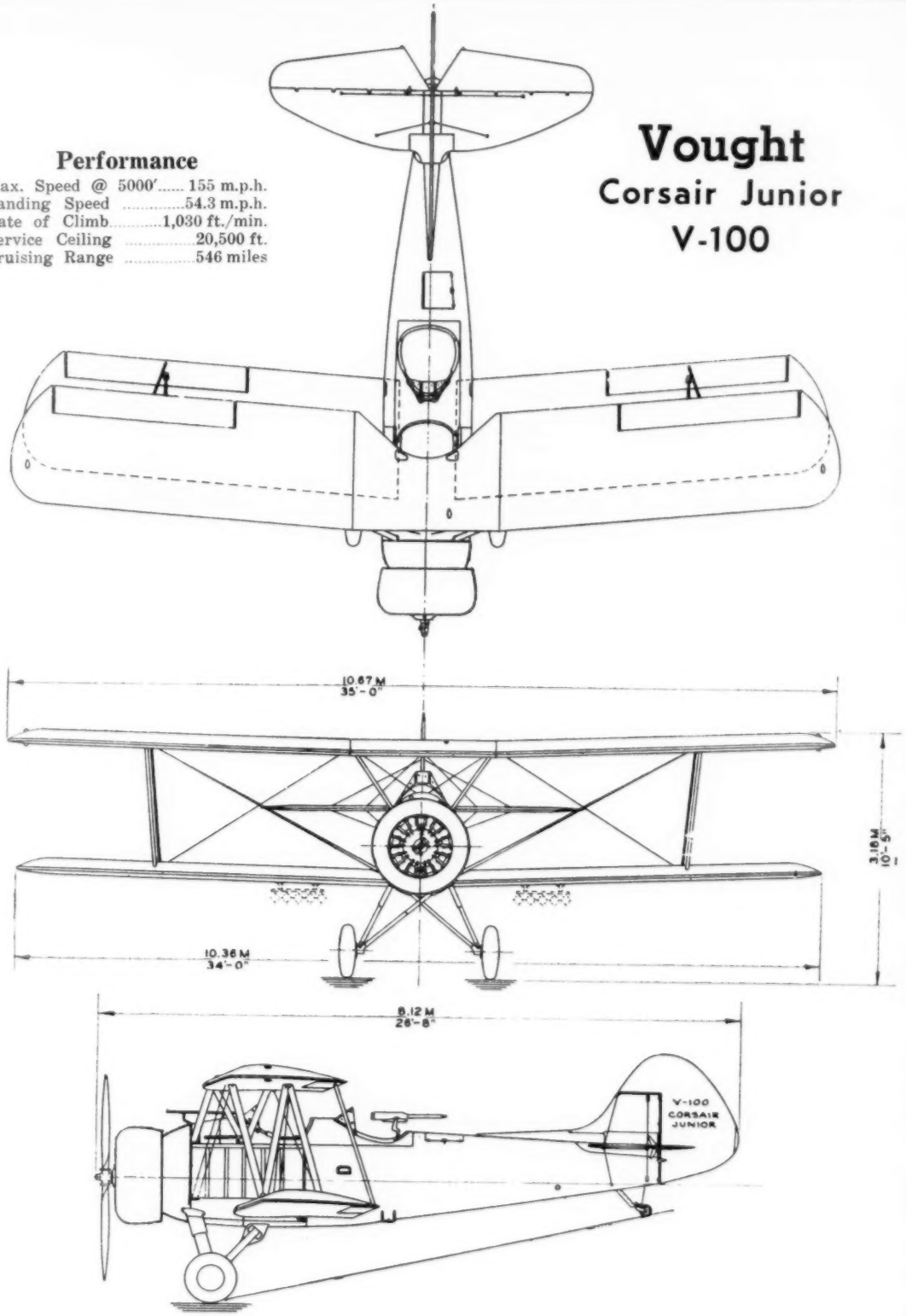


Layout of armament installation showing the location of the fixed machine gun, etc., on the Corsair Junior, Type V-100.

Vought
Corsair Junior
V-100

Performance

Max. Speed @ 5000'..... 155 m.p.h.
Landing Speed .....54.3 m.p.h.
Rate of Climb.....1,030 ft./min.
Service Ceiling .....20,500 ft.
Cruising Range .....546 miles



Corsair Junior

(*Continued from page* 356)

wheel is used. The engine is the Pratt and Whitney Wasp Junior, Model SB, capable of developing 400 horsepower at 2,200 R.P.M. at 5,000 feet.

It is equipped with pressure baffles, N. A. C. A. cowl, Stromberg Carburetor, Scintilla magneto, carburetor air heater, oil temperature regulator, fuel pump, radio shielding and exhaust stacks. A Hamilton-Standard metal propeller and Eclipse hand inertia starter are standard equipment, and the engine compartment is fitted with a Phister pressure type fire extinguisher.

The fuel and oil systems are patterned after the standard Corsair installations, with 88 gallons of fuel being carried in two main tanks mounted in the latest type of cushioned supports, and in a welded aluminum tank of 6½ U. S. gallons capacity.

Complete dual engine controls, instruments, and surface controls are provided, with brakes on the front pedals only. Seats and rudder pedals are adjustable to suit the pilots, and the rear seat and rear control stick are removable when necessary, for other functions. All of the cockpit installations are similar to those of the standard Corsairs which are based on thousands of hours of flying experience.

All materials, workmanship, and finish conform to stringent requirments similar to those imposed by the U. S. Government, and the strength of all parts of the airplane have been determined in accordance with U. S. Government requirements.

The performance of the Corsair Junior as a landplane, based on flight tests, is as follows:
Maximum Speed at 5,000, 155 M.P.H.
Landing Speed, 54.3 M.P.H.
Rate of Climb (Sea Level to 5,000 feet) 1,030 Ft./Min.
Service Ceiling, 20,500 Feet.
Cruising Range, 564 Miles.
Weight Empty, 2,405 Pounds.
Normal Useful Load, 1,154 Pounds.
Normal Gross Weight, 3,559 Pounds.

This type of light military plane marks the present tendency toward more economical operation in training, policing and similar missions. It is a valuable adjunct to the extensive air services of the large nations as well as acting in a major capacity for the smaller countries where large and expensive ships are a prohibitive financial burden.

Caproni in Italy and Bleriot in France have both developed light military planes of this type which have proved very satisfactory and economical in operation. Great Britain has several makes of the same general nature which have been in operation for a considerable length of time. In Asia and South America, light military planes are the rule rather than the exception.

The Aero-Sportsman

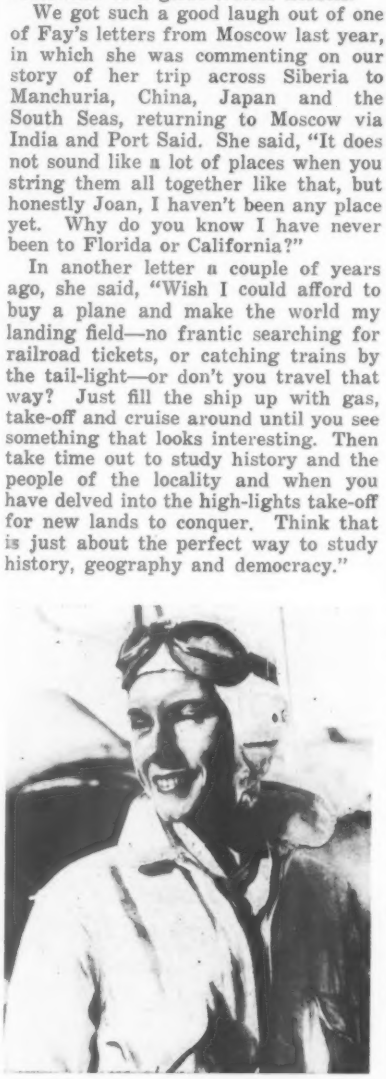
by JOAN THOMAS

AERONAUTICALLY speaking, things are beginning to happen here, there and everywhere. We have such a variety of notes in our folder this month that it is hard to know where to begin.

However, our interesting young friend, Fay Gillis has been getting a good deal of publicity recently by getting herself married to Linton Wells, war correspondent and globe-trotter. All the newspaper stories tell about Fay's flying activities and membership in the Caterpillar Club and enlarge upon Mr. Well's 28 days, 14 hours and 36 minutes round-the-world-trip. That may seem a bit slow after Wiley Post's seven days, but the thing that bothers us, is the fact that the newspaper writers seem to forget that Fay is somewhat of a globe-trotter herself.

We got such a good laugh out of one of Fay's letters from Moscow last year, in which she was commenting on our story of her trip across Siberia to Manchuria, China, Japan and the South Seas, returning to Moscow via India and Port Said. She said, "It does not sound like a lot of places when you string them all together like that, but honestly Joan, I haven't been any place yet. Why do you know I have never been to Florida or California?"

In another letter a couple of years ago, she said, "Wish I could afford to buy a plane and make the world my landing field—no frantic searching for railroad tickets, or catching trains by the tail-light—or don't you travel that way? Just fill the ship up with gas, take-off and cruise around until you see something that looks interesting. Then take time out to study history and the people of the locality and when you have delved into the high-lights take-off for new lands to conquer. Think that is just about the perfect way to study history, geography and democracy."



Jean Batten who set a new women's record for a flight from England to Australia.

Fay Gillis (left) and Ruth Nichols were among those present at the fashion revue sponsored by the 99'ers.

We wrote to the newly-weds and suggested that they fly around the world on their honeymoon, maybe they could make it a non-stop flight, since that is one of the few records yet to be established. Anyway, knowing Fay's gay spirit, love of adventure and insatiable curiosity about anything and everything, we know she is going to have a lot of fun out of life wherever it may take her.

* * *

IN March, the New York chapter of the 99 Club, staged a fashion revue in the ballroom of the Hotel New Yorker in connection with an aviation exhibit being held there. Famous women pilots acted as manikins, displaying forty-five original models especially designed for airwomen.

There were costumes for every hour of the day, and for business, sports and evening wear. Many of the costumes were made of "flight-tex," which is aeroplane fabric adapted to costume design and they bore such intriguing names as "Take-Off," "Cloud Bank," "Fair Weather" and "Perfect Visibility."

Some of the names given to the costumes indicated the achievements of the famous manikins who wore them at the exhibit. For instance, Mrs. Martin Johnson, the explorer's pilot-wife wore a creation of flowered crepe named "African Skies," Ruth Nichols appeared in an evening gown of chiffon in four shades, blue, green, yellow and purple, called "Record Breaker." Fay Gillis, as a member of the Caterpillar

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Wrangling Horses by Plane

by CAPTAIN ALBERT E. WAITE

Here is a new application of the airplane that is meeting with success in the West. The airplane has now become an aerial cow-pony while the pilot is acting in the role of cow-puncher.

THE world moves on! The last decade has relegated into the background of events the colorful and picturesque cowboy a once familiar sight.

There was a time when every youngster wanted to grow up to be a cowboy, so he could wrangle cows and, if lucky, experience the thrills of wrangling wild horses. This has all passed and now he wants to be an aviator.

The latest wrinkle is the wrangling of wild horses by airplane. The youth of today and of yesterday, sitting in the cockpit of an airplane, can still enjoy some of those thrills they once expected to enjoy from a horse's back.

If you have an idea that sitting in the cockpit of an airplane zooming along at 90 miles an hour in a treacherous mountain region, as low as ten feet from the ground wrangling wild horses, is not a thrilling as well as a hazardous sport, just try it and you will change your mind.

It was last summer that I with Charlie Kendall and his airplane and with Ernie Moe, a transport pilot to do the piloting, left Sacramento, California, for Garfield Flats, Nevada, 4,500 feet above sea level. This was to be our headquarters while we wrangled wild horses with the airplane from the mountains which rose another 5,000 feet higher. Both Ernie and myself are licensed pilots but we felt incapable of doing the flying we knew would be necessary.

Here is the horse-wrangling crew and their plane. LEFT TO RIGHT. Ernie Moe, Charlie Kendall and Captain Albert E. Waite.

LEFT TO RIGHT. Jerry Barker and Captain Waite. Barker joined the horse-wrangling crew when Ernie Moe was called home.

Garfield Flats is a small valley in the hills between Mina and Hawthorne, 250 miles northwest of Boulder Dam. Here, the cowboys who were to act as our ground crew, had their line camp. A mile from it was one of the large mud lakes which are quite prevalent in Nevada. Some of these lakes dry up during the summer and make ideal landing fields.

Landing was very deceiving on this flat. The mud, when it dries, turns to a light clay color and distance is hard to judge. We all felt sure we were going to overshoot our mark and land in the sage brush at the edge of the lake bed, but after landing terrifically hard, we still had a half mile to taxi to the shore line.

Our reason for making this trip to Nevada to wrangle wild horses was not alone for sport. It was an experiment to determine if these wild devils could be wrangled successfully enough to make it a paying proposition and thus create a new commercial use for the airplane.

We knew that if we could prove the value of the airplane, that in time it would be adopted by the cattle men of the states where the horses range for they have every reason to eliminate as many of these hundreds of bands of horses as possible. Wild horses are found extensively in Nevada, Oregon, Wyoming, Montana, Arizona, New Mexico, and Texas.

Every year they destroy hundreds of acres of grazing feed, leaving in many places little for the cattle. In 1927 the number of horses in Nevada had grown to thousands and they were threatening to drive the cattlemen from their ranges.

It was attempted to run them down in bands with saddle horses but this was not successful. This method, literally speaking, has never been very successful because the wild horses can so far outrun the saddle horse with his load of a saddle and rider, that it is almost funny.

At that time, in Nevada, the cattlemen got together and sent a protest to the United States Government. The government sent out cow hands with instructions to shoot as many of the fuzzies as possible. Hundreds were killed. This was an expensive adventure and an unpleasant one, as it was necessary to leave the horses where they fell.

After experimenting for two weeks we came to the conclusion that horses could be wrangled successfully by airplane if the proper plane and corral were used. Despite our work being experimental, we caught sixty horses in the corral we set up in Whiskey Flats, another valley about twenty-five miles from Garfield Flats.

At first, our greatest trouble was to guide the horses. The first few days proved to us it was folly to fly over them for it scattered them in every direction. Eventually we found out that by flying behind the horses in a figure eight we could guide them satisfactorily.

The way this worked was this. If the horses were headed west, we would fly a figure-eight back of them from north to south. If the horses veered to one side of the course we wanted

them to follow, we merely had to drop the plane in a figure eight around to the side of the band and they would straighten out again.

We found that we could bring the horse bands down from the pinnacles for distances from 15 to 20 miles into the valley and direct to the corral, but because of the type of corral we were handicapped. The ground crew could not keep the horses in the corral after we brought them down for them. This corral was a small circular affair with a wing running out for a mile on each side.

We found the type of corral that can be used successfully is diamond shaped, enclosing from ten to 15 acres of ground. At one end there must be a small catch corral into which the horses can be driven for roping. At the other end an opening of 200 yards must be left, and from this opening a wing fence must extend for a half mile on each side. The reason for having the large area enclosed by the diamond shaped corral is to give the ground crew enough time to pull a wire across the 200 yard opening so the horses cannot get out again, and to give them plenty of room in which to mill. The corral fence should be made of strong wire and posts. It should be as nearly invisible as possible so the horses will not charge it. The wire pulled across the gateway must have strips of cloth tied on it to keep the horses back.

Some of our flying experiences encountered, if you could have been present and seen them, would have made your hair stand on end. It was necessary to fly from ten to twenty feet above the ground, while guiding the horses. This provided one thrill after another. On one occasion, we flew so low that the wheels bounced on the ground.

Flying in the valley where the corral was located was extremely dangerous and exciting. The floor was split up into small gullies by hills rising from thirty to forty feet into the air. A lack of vegetation in the valley and on the mountains reduced the danger somewhat. The valley was full of up and down drafts caused by the wind coming over the high mountains at the west and boiling across the floor to the mountains on the east. This made it dangerous flying so low to the ground.

If we got close to the west range of mountains we had to fight the down draft in order to keep up. If we flew too close to the east range, we were likely to find ourselves several hundred feet above the crest within a few seconds.

Finding that our corral was not constructed correctly we took a few days off and remodeled it. We moved our headquarters to Hawthorne, which put us nearer the corral by several miles. In the meantime, Ernie had to go home and Jerry Barker, owner of

(*Concluded on page* 405)

This Autogiro Has a Folding Rotor

The new Autogiro takes off from a narrow city lot.

AT last, an attempt has been made at making the Autogiro an everyman's vehicle. The latest development in this line is capable of being operated without the aid of an extensive airport or large hangars.

Jim Ray, Hatboro, Pa., himself a noted Autogiro pilot, recently demonstrated the practicability of the new wingless folding rotor type Autogiro when he landed it at Garden City, Long Island. After landing his ship, Ray folded the rotor and rolled it into a single car garage which afforded plenty of room for the 'giro as shown by the accompanying photo.

Later, he opened the garage, pulled out the Autogiro, spread out the blades of the rotor, taxied to a nearby vacant lot and took off with ease.

When its rotor is folded, the Autogiro is stored in a single car garage.

Makes a Photographic Flight Over St. Elias

THE first airplane flight ever made over the St. Elias Range of mountains on the Alaska-Canada border was announced in a despatch from Bradford Washburn, leader of the Yukon expedition, to the National Geographic Society of Washington, D. C.

The flight was a photographic mission, and the report stated that a large number of photographs were secured of hitherto unknown glaciers and peaks. The report to the Geographical Society said: "The number of unknown glaciers and peaks which we have seen and photographed on our first two flights is almost inconceivable."

The flying was done in a Fairchild cabin airplane at an altitude of 18,000 feet in sub-zero weather. The expedition is equipped with a Fairchild F-8 aerial camera which has a negative size of 5x7 inches and weighs 18 pounds, and also with a Fairchild K-3B aerial camera which has a negative size of 7x9⅛ inches and weighs 40 pounds.

The plane was in the air seven hours, taking off and landing at the base established at Carcross, Yukon Territory. The door of the Fairchild cabin plane was removed so that the cameras could be aimed at the surface without any interference. The aerial survey is to be followed up by mapping parties on the ground. At least one more aerial photographic flight is scheduled, the report stated.

Increasingly, the airplane is becoming of assistance to explorers and naturalists who travel unknown paths in unbroken country. It is independent of ground conditions and calls for no trails.

Flying in the Sky-Parade

by LIEUT. CRUTCHFIELD ADAIR, U.S.N.

What the pilots think about and what they do when all lined up in a huge formation flight of 200 planes or more.

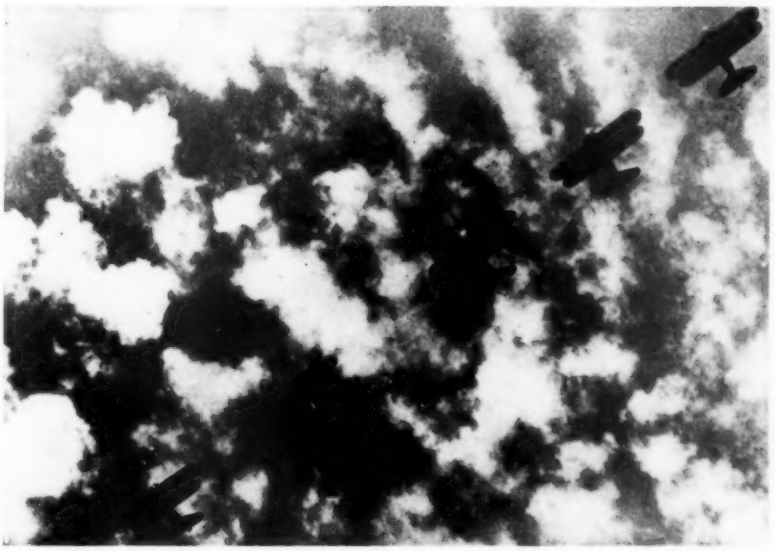
NOT so long ago I took part in a sky parade consisting of more than 200 airplanes in formation.

A thought occurred to me: I wonder how this looks from down below! Many people have the opportunity to observe the spectacle from below but it happens to fall my lot to be in the procession each time. As comparatively few have seen a mass formation from a participating machine there are probably many back scene preparations and strange sensations of which the observer below is not aware.

The task of getting, say 250 planes from the ground into the air for a common maneuver is a big one and requires, among other things, space. There are but few fields in the country that are of sufficient size to accommodate this number of planes. North Island, San Diego, and Norfolk, Virginia are two such bases.

Strange to say, the United States Navy possesses what amounts to a movable field that can take care of about this number of planes. It is divided into four parts and consists of the flying decks of the aircraft carriers U.S.S. Saratoga, U.S.S. Lexington, U.S.S. Langley, and the U.S.S. Ranger.

Air parades on more than one occasion have been launched from the decks of these carriers. In planning an air parade, a small but important piece of paper is passed around to the various units disclosing a time schedule which states precisely when each unit shall take off and which gives, equally as precise, the hour and minute to "form up" in the air. This time schedule is important and is strictly followed to prevent confusion taking the place of coordination.



Courtesy of U. S. Navy

Torpedo and Bombing Plane squadron of the Battle Fleet outlined against the sky during the recent maneuvers. Note the exact alignment of the naval planes.

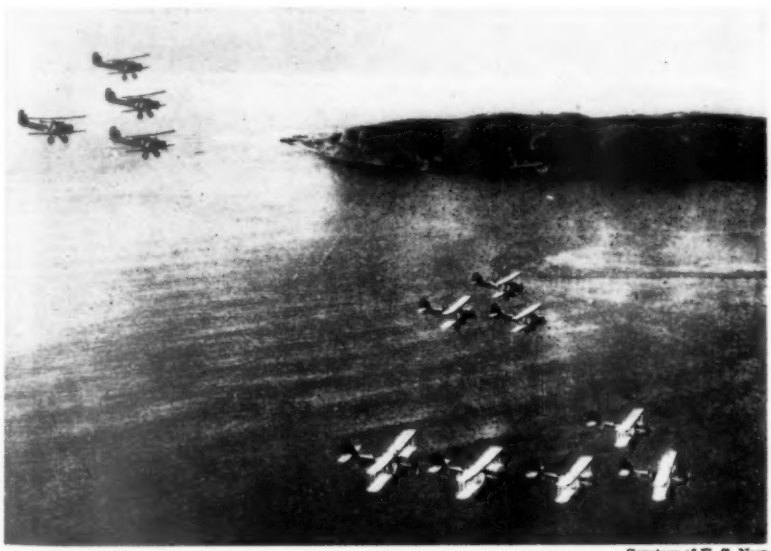
Planes immediately form into squadrons upon take off and squadrons form into "wings" and "wings" take their assigned places in column and this forms the parade. The pilot sees many planes, of course, but not the geometric patterns of planes that can be observed from below. He sees planes on each side and planes ahead. His attention is taken up throughout the flight in maintaining his proper distance from adjacent planes and keeping the line of bearing constant.

If he should find time for a quick glance around behind, he will find still more planes back there. The calm even flow of planes, as viewed from the ground, is vastly different to the flyer in the midst of them. He is surrounded on all sides by roaring motors and is so busily engaged in following the movements of leading planes that the deafening noise gives him but slight concern. He is used to it and it causes no distraction.

Planes bob up and down continually because of the ever present air currents and while this movement is so slight as to escape notice from below, it actually amounts to sudden jerks up and down from 5 to 10 feet or more.

If a citizen from the ground could suddenly transpose himself to a seat in one of the planes he would surely gain the impression that air currents are close akin to ocean waves, providing a strong southeast wind is blowing. When you are flying singly in a plane you are not aware of the vertical motions so noticeable when flying in close formation.

(*Concluded on page* 398)



Courtesy of U. S. Navy

Torpedo and bombing planes of the Battle Fleet, U. S. Navy during maneuvers.

The Dreamships Return

Well, in spite of our announcement made last month, we have been compelled to return the Dream-Ship department due to the overwhelming demand by our readers. And, so, here you are fellows, get out the old pencil and paper and show 'em how to design airplanes. Make every bedroom—as Oswald says—an airplane drafting room.

NO matter how we try, the Dream Ships always come back after a short vacation. A howl of dismay went over the land when we made our announcement, last month, that this feature was to be eliminated. We couldn't withstand that blast of disapproval, so here are the ships again boys.

To start the ball a-rolling, we have headed the column with the ideal ship as visualized by "Izabo." Just how to classify this phantasy or what to call it is beyond us, but annywhoo, we'll attempt to give you a few pointers on what is really a "mystery ship." It is built on the general plan of one of those Malayan parrots which are said to roost upside down on the banana trees of the Malayan Peninsula.

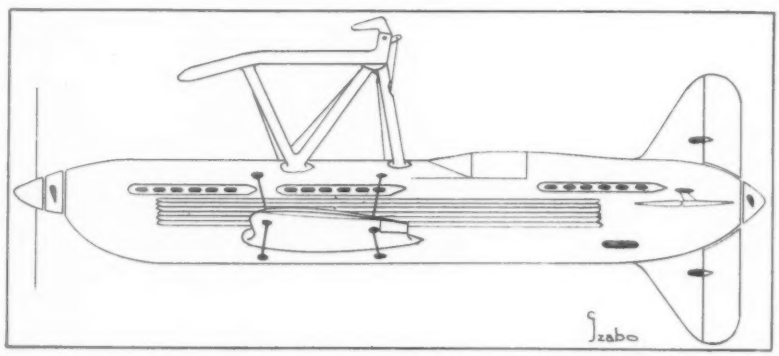
That dingus that you see on top of the fuselage is a hook-on cabane by which the ship is suspended from the mother ship. The mother takes up her speedy baby, and when flying speed for the racer is attained, the hooks are released and away she goes on her own wings. However, it would seem to us that the hook-on, as drawn, would create almost as much resistance as a landing gear or hull, but then it is obvious that this could be shortened up until it barely projected above the top of the hull. Under such conditions, Izabo's ship should do a flock of m.p.h.

And now we get down to the second drawing by a reader who very modestly signs himself "JK." This is a tractor plane built along the lines of a pusher cabin job which recalls the design of the mailplane designed by the late Clare Vance. The elimination of the after portion of the fuselage permits of a short low resistance cabin and is a design that would probably eliminate the "blind-spot" at the tail group. The whole design is well thought out and looks very feasible.

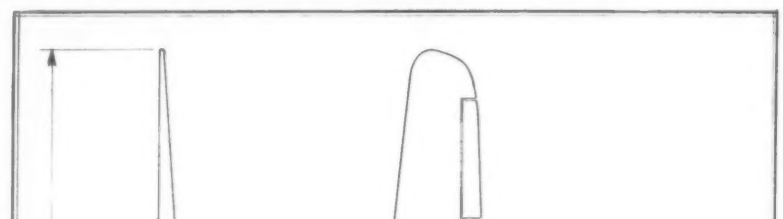
It has an excellent field of vision in all directions, and it would seem that the tail group arrangement would avoid any tendency toward spinning as it is not blanketed by the after part of a long fuselage. An effective tail group is an item of great importance and was one of the leading features of the Vance ship.

While we have a number of dream ships in stock, we will be open for more contributions to this department in about a month, so put on your nightcap and dream up some more designs in the meanwhile. What we want is original ideas but not freaks nor impossibilities.

Well—Well, Look 'em Over, Boys!



We don't know just what to call this high-speed ship without landing wheels or pontoons, but we will let you write your own ticket. It takes off from another carrier plane when the hook is detached. Very original, Izabo, we hope it works out.



This is a very cleverly arranged cabin ship, on the lines of a pusher but with a tractor propeller. It reminds one of Clare Vance's ship with its tapering outriggers and it would seem that the elimination of the rear portion of the fuselage would very much improve the aerodynamic qualities of the cabin.

Will Alcohol Mixtures Rule?

by KEITH J. FANSHIER

And now politics is again trying to meddle with aviation, this time with the fuels employed for driving the ships through the air. Alcohol-gasoline mixtures may help the farmer, but—!

SETTING—Time, the present; place, a Middle Western American countryside and the air above it.

CHARACTERS—Yourself and your sweet-running plane, your motor functioning perfectly, the country slipping by below you, and your feeling of exaltation which never quite separates itself from flying.

Suddenly your power fails, the motor dies, you are unable to re-start it. You prepare for a forced landing and you make a fairly decent job of it in an open field. Your suspicions of an empty gasoline tank prove too true—bone dry! You hitch-hike your way to the nearest filling station and hitch-hike back with ten gallons of gasoline, pour it in, off you go.

And you arrive at the nearest airport without further incident.—Or do you?

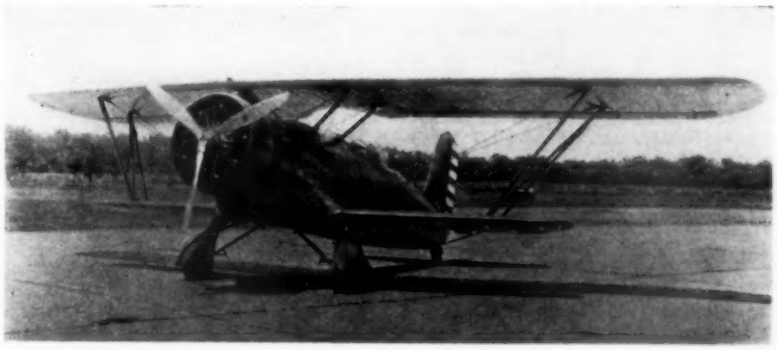
Are you sure of what you poured in your tank? The chances are that, under such conditions, you are not sure.

Here is the point: You have been hearing a lot about the plan for alcoholized motor fuels. You have felt that this was idle chatter, or at least something for consideration in the far future. But you are wrong. The fact is that alcohol-gasoline blends are being sold as motor fuel in numerous cases in the Middle West and even in some other parts of the country today. It is not something which may be coming. It is something which is here.

Hence this article. In view of the serious handicaps from a utility and operating standpoint, which such a fuel as an alcohol-gasoline blend yet has to overcome, it should be used in aircraft engines only under the most extreme cases of necessity and then the user should go into the thing with his eyes wide open, knowing what he is doing.

The outcome of your little episode, described above, may well have been serious indeed if the new material you poured into your tank happened to be an alcohol blend. The result might have been a sputtery dying engine and another forced landing, under circumstances not so fortuitous as those governing the first one. All of which is by way of warning aviation to watch for alcoholized motor fuel and to be alive to its possibilities at present; to regard it not as something which may eventualize and should be dealt with in the future but something that is here now.

Therefore, aviation should be making up its mind as to what it wishes to do about it, and without any extensive delay.



In time of war, a well developed alcohol base fuel may be of great importance for military planes of this type at a time when the gasoline production is over-taxed, but until then, we still have faith in straight gasoline.

This writer has several times called attention to the seriousness to aviation of the possibilities devolving from the use of alcohol-gasoline blends. The facts as presented in those articles so far as is known continue to apply today but even more so because the whole question has withdrawn itself from the somewhat vague and hazy outlines of the remote future and has plumped down into our laps today.

It is true that the leading units of the major oil companies today are not selling such products. Yet such products are being sold in some cases. The cases are those of several chain station owners, especially in the Middle West where the grain belt agitation for cereal grain alcohol blending has been hottest.

At the moment there is little danger that alcohol-gasoline motor fuel will be foisted off upon aviation without notice at any well-regulated airport or landing field. However, it is well to keep the situation in mind, because every conceivable effort is being made by a lobby and organized group of interests favoring blending of alcohol to force such blends upon the motorists and upon all users of motor fuel.

It probably is not necessary at this time to go over extensively the technical reasons why an alcohol-gasoline blend under present conditions is a motor fuel totally unsuited and actually dangerous for aviation use. Those reasons advanced previously will probably hold good in most cases today. What happened to "you" in the little scene pictured above was the result of the long-known tendency of alcohol to stratify when mixed with another product in which there is the presence of only an extremely small amount of water.

Since it is next to impossible to conceive of an alcohol-gasoline blend without existence of at least a little water, such stratification is seen as a serious matter, especially since it is generally agreed that somewhat extensive adjustment of fuel system or perhaps even more far-reaching modifications of engine and supplementary items is required in switching over from a straight petroleum product to such a blend.

Leading the fight for a blending program now is none other than the Chemical Foundation of New York City, which holds patent interests in connection with various chemical processes, uses, formulas, etc. The corn processing people are vitally interested. All the farm associations, and farm "relievers," both national and state, are heavily involved. Many state legislatures in the farm regions are becoming greatly involved, and legislation now is pending in congress which virtually would force the use of the blended products on a vast, tremendous scale.

The most common proposal is for compelling use of blended gasoline on the basis of a high tax rate on sale of gasoline not so blended. The blending campaign backers assert that their principal interest in the whole thing is in improving the lot of agriculture, in enlarging and extending the demand for their products—thus improve the lot of agriculture and you improve much else in the economic scheme of things.

Of course, the whole project is highly theoretical. All its phases are surrounded with doubt and question. It is difficult to believe, for example, that the price of such a product would be sufficiently low to avoid knocking out a vast volume of motor fuel consumption now existing, and thus tending

to kill the goose that has been laying the golden eggs.

Proponents of blending now tell us that means have just been devised whereby such a blended product will not stratify. This statement has an extremely specious sound, in view of the fact that two years ago, at the height of the preliminary campaign for blending, it was emphatically denied that stratification would result. Of course, stratification is only one objection to an alcohol-blended motor fuel. One is the effect on the parts of the motor from coming in contact with the motor fuel or its exhaust gases. Another would be the difficulty of obtaining uniformity and the need for constant engine adjustments. Such a situation, it is easily seen, could play havoc with aviation.

The petroleum industry has been fighting determinedly the blending program, and probably will continue to do so. It is not known whether or not the bills now pending in congress are to be regarded as having a fair chance of passage. But even so, there are numerous state legislatures considering alcohol gasoline blending proposals.

One state, Iowa, has established preferential freight rates for railroad movement of alcohol to be used for such purposes, and at least one important alcohol-gasoline blending plant has been set up in the state. Nebraska also is active along the same line. The whole proposal, of course, took its birth from Illinois and it is receiving strong sponsorship in this state.

The question of the competitive claims of those who are promoting alcohol blends as motor fuels raises some interesting angles. For example, while these interests universally assert that such blends constitute motor fuels of superior qualities in comparison with gasoline, there is no thought on their part that such products should be placed on the market in a competitive battle with gasoline and allowed to sink or swim on the basis of the decision of the consumer as to which he desired.

The only basis on which these interests are willing to rest their case is one of compulsion. There shall be no free choice. The legislative proposals to date are mainly of two kinds —that a vast, extensive machinery shall be set up to drive from the field all motor fuel excepting that which contains a substantial percentage of alcohol, or that the straight gasoline shall be taxed varying amounts, so as to persuade the consumer to use the blended material.

Of course, in the case of the blended products now being sold by the scattered concerns mentioned above, there is no effort at compulsion and the material is being offered for sale on the basis of support for farm belt industries.

In these days when the young industry of aviation is finding many dif-

(*Coneluded on page* 400)

Progress of the Amateur Aircraft League

by LESLIE LONG, Chairman

The amateur is the backbone of aviation and has been, ever since the Wrights—themselves amateurs —made the first flight.

WELL, here we are back with good old P. A. again. Most of you will remember that P. A. was the magazine that gave this amateur organization its first start in life.

This League is strictly an amateur affair. It specializes on the true lightplane. Its principal purpose is to obtain more liberal and just laws and regulations for the amateur aviation group.

As this is being written, most of the states are holding legislative sessions. In the state of Washington, which has been under Federal regulations for several years, a bill is under consideration which will bring control back to the state. If it goes through it will mean that between 50 and 60 wrongly grounded airplanes will once more take wing.

Here in Oregon, the big battle is all over. And we WON! The amateur David walked out and smote the commercial and political Goliath hip and thigh. If private flying is to live, the same thing will have to be done in every state in this Union.

A campaign was mapped out several months ago. The first thing we did was to get out a little pmaphlet, stating the case of the amateur flyer and the harm that was being done by putting him out of existence without just cause. One of these pamphlets, with a personal letter, was sent to every Senator and Congressman in the state.

Three bills were introduced, all by the commercial group. They were of the usual type, and plain dynamite to the amateur. Knowing of the interest in these bills, the aviation committee set a date for a public hearing and that was where things happened. Between 75 and 100 earnest and determined men, every one a pilot or owner, swooped down on that meeting and it was soon over. After listening to the testimony no just man on earth could demand that these men be deprived of their property and rights simply because some one wanted it done. The bills were tabled then and there and everybody went home happy.

The outstanding speech for the amateurs was made by none other than Tex Rankin, noted pilot and aviation executive. He spoke with clearness and authority and his remarks carried great weight. Representative E. L. Ross spoke directly of and for the A.A.L. and his speech was good. Senator Zimmerman was of great help to us, as were many others.

There is no reason why every state in the Union can not do the same thing. As the membership fee for joining the A.A.L. is but 10 cents. There is no fund for such work. Expenses must be paid by local members as was done here, but the cost is not great. The great advantage lies in the fact you have justice on your side. The demand for a Federal license from an amateur builder simply means prohibition and denial of rights for him and an outright loss to the industry and the future welfare of the country.

It was brought out at the committee meeting that, although Oregon has permitted the flying of unlicensed ships ever since the Department of Commerce took control about eight years ago, only six fatal accidents had occurred in the state that were in unlicensed planes. All but one or two of these were in ships that had once been commercial or military machines, such as the old Jenny and other similar types. That is a fine record, and speaks well for the amateur's ability and the efficiency of the State Inspection department.

The Oregon system is distinctly practical and should be the basis for a uniform National law. It is much like the Canadian law. Under it, no commercial work of any kind is permitted and pilots are required to be competent and careful. Several states have sent for copies of our law and it is to be hoped they will adopt similar ones.

It is hard to understand why the Department of Commerce has so persistently refused to relax its restrictions on the amateur group. If they had been as liberal as this state the private flying class would be ten times as large as it is.

High-Lights and Side-Lights

by M. A. RODDY

Brief news notes on aviation activities and upon prominent personalities in aviation who are responsible for the progress of aviation.

BEHIND THE SCENES: Following a series of conferences in the White House attended by representatives from the House and Senate Post Office and Post Roads Committees and the Post Office Department a measure was drafted by Congressman Donald Dobbins of Illinois and introduced to the House by Chairman James Mead where it was passed and sent along to be sponsored in the Senate by Senator Joseph O'Mahoney of Wyoming. . . . It is generally agreed by both the air line pilots and the operators that the Mead bill will materially aid the industry, which needs HELP QUICK!

* * *

DURING a debate which preceded passage of the Mead bill Representative Melvin J. Maas of Minnesota and former aviator, charged that Elliott Roosevelt was a "lobbyist" for aviation concerns and that as vice president of the Aeronautical Chamber of Commerce he received an annual salary of $15,000 having been raised from $10,000 for GOOD WORK. . . . Elliott denied the charges and stated, "Those interested in the work that I am doing, can find out by inquiring."

O. K.! I'm INTERESTED. . . . Now, what are you doing?

* * *

WITH aviation just about punch-drunk from being saved along comes Chairman John J. McSwain of the House military affairs committee with a bill, which proposes to place the Air Commerce Bureau and military aeronautics under one BIG department and besides a few noted pilots, the usual number of ground flyers have been invited to testify. . . . It appears as if these aviation committees are all using the same Kiwi list.

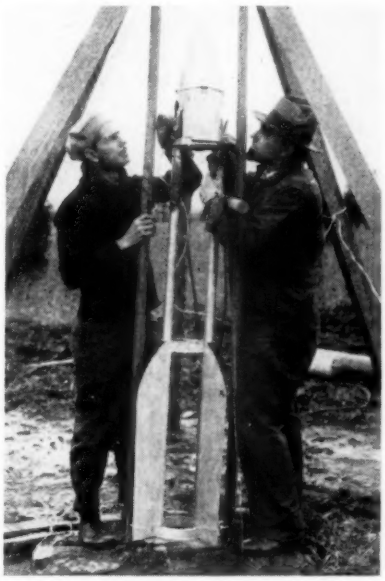
* * *

DID you know that there has been over $100,000,000 spent in air mail subsidy? Well, there has! Postmaster General James Farley, of whom you have heard Huey Long speak, announces that 931,425 pounds of air mail carried during the month of December constitutes a new all-time record being an increase of 41.72 percent. over the same month in 1933.

* * *

OCEAN AIR SCHEDULES: Pan American Airways are now busily engaged in locating bases for the company's proposed trans-Pacific operations and it is expected that Colonel Charles A. Lindbergh will make one of the experimental flights, which will extend from California to Hawaii, 2,410 miles; to Midway Island, 1,380 miles; to Wake Island, 1,242 miles; to Guam, 1,450 miles; to Manila, 1,500; thence 700 miles farther to connect with the 3,000 miles system of PAA in China proper. . . . Eventually passengers will be able to fly from San Francisco to Canton, China, in four days, a trip which now takes a steamer at best over three weeks.

Establishment of the Pan American project really puts Wake Island on the map, as in 1841 Lieutenant Charles Wilkes, American naval explorer, visited the island to determine its position but did not think it worth mapping.



Rocket experimentation deserves notice in present aviation progress. Will the rocket supersede the airplane?

BARON AMAURY DE LA GRANGE, head of a French aviation commission, which recently completed an extensive survey of American airways, believes that regular trans-Atlantic flying service will be in effect in 1937. . . . Jean Mermoz, chief pilot for Air France and famous for his many flights across the south Atlantic favors fast land planes for ocean lines, contending a quick passage is safer than theoretical ability to land on the sea.

There is some talk that Inter-Island Airways of Honolulu may compete with Pan American in the operation of a new air line between San Francisco and Honolulu.

* * *

HIGH speed delivery of air mail from 120 to 200 miles per hour is being planned by the British government to furnish service to all parts of the empire. . . . In preparation for the future carriage of all first class mail, Imperial Airways intends to place orders for 50 luxury airliners. . . . And there, Mr. Farley, is something for you to think about. . . . First class mail for United States Airliners!

* * *

HARMON TROPHIES: C. W. A. Scott has been designated the champion aviator of 1934 and awarded the Harmon prize in recognition of his flight with Campbell Black from London to Melbourne winning the MacRobertson race. . . . Dean C. Smith, American Airlines pilot who was with the first Byrd expedition to the Antarctic, was among the national winners for the United States.

* * *

THE international trophy for dirigibles was awarded to Captain Ernest A. Lehman as Dr. Hugo Eckener, skipper of the Graf Zeppelin, had previously been honored five times and was therefore ineligible. . . . Mrs. Jean Piccard became the first woman ever to win a Harmon trophy except the aviatrix awards because of the successful stratosphere ascent she made with her husband last October. . . . Helene Boucher received posthumous mention for the new woman's speed mark of 276 miles an hour. . . . Lieut. Commander H. V. Wiley received the American award for dirigible pilots while spherical-balloon honors went to Major W. E. Kepner. . . . Miss Laura Ingalls received national honors for her 22,000 mile South American solo flight. . . . Other winners were: Argentina—Edgardo Bonnet and Marta Leloir de Udaondo. Australia—Charles Kingsford Smith. Belgium—Teddy Franchomme, E. Demuyter and Mlle. S. Lippens. Denmark—Michael Hansen. Finland—U. Makela. France—Jean Mermoz, Raymond Delmotte and Germain Bonnet. Germany—Heini Dittmar, Hans Kurt Flemming and Elly Beinhorn. Holland—K. D. Parmentier. Italy—Francesco Agello. Japan—Monosaburo Shinno and Kikuko Matsumoto. Poland—Captain Jerzi Bajan and Franciszek Hynek. Portugal—Humberto da Cruz. San Salvador—Herman Baron. Siam—Luang Prung Prechakas. Spain — Ramon Torres. Switzerland—Walther Mittelholzer.

* * *

BRIG. GEN. HENRY H. ARNOLD, commander of the West Coast Wing of the General Headquarters Air Force, has won the Mackay trophy for the second time as a result of his

leadership and conduct in directing a mass flight from Washington to Alaska and return. . . . In 1912, as a young second lieutenant, Arnold won the Mackay trophy for a "daring" flight from College Park, Maryland to Washington and return in 41 minutes, "suffering complete exhaustion" according to War Department files. . . . General Arnold joins Captain Oakley G. Kelly and Lowell H. Smith as a "repeater" among holders who are still with the Air Corps, as Lieutenants John A. MacReady and Erik H. Nelson have left the service.

* * *

CUPID made a successful flight when Florence Desmond, British actress, changed her mind and decided to keep her promise to marry T. Campbell Black for winning the London to Melbourne derby last autumn. . . . Earlier press reports declared that it was all OFF. . . . Orange blossoms are also in order for air mail pilot Larry Pugh and Miss Julia Barker.

* * *

H. L. BROOK has established a new solo mark for the flight between England and Australia of seven days, 19 hours and 50 minutes. . . . Pilots Wayne Williams and R. W. Heideman set a new transcontinental record for scheduled transport planes flying from Los Angeles to Newark in an elapsed time of 12 hours and 44 minutes. . . . Not to be outdone Otis Bryan flew 13 passengers the 410 miles between Kansas City and Chicago in 103 minutes.

* * *

ALL IS not WELL WITH Eugene Vidal's blind flying tests according to word that I get from Oakland which indicates Major Chester Snow, chief of the government's experiments with a new radio compass for ocean flying, wrote his resignation during an ocean test flight because permission was not granted for the robot controlled plane to continue on to Hawaii. . . . Associated with Major Snow were Capt. Alfred F. Hegenberger, navigator on the first Oakland-Hawaii flight in 1927 and Capt. Clayton Bissell.

* * *

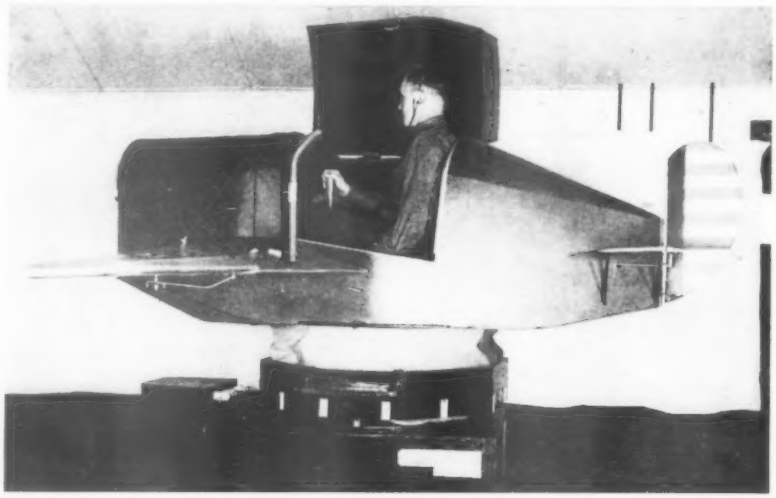
SECRET tests have been made by the Navy of a new giant high-winged monoplane which is an armored air cruiser equipped for bombing and machine gun strafing. . . . British engineers have also secretly developed two stratosphere planes with which Britain hopes to smash all records for altitude, distance and speed. . . . It is claimed that the stratosphere planes are designed to climb to 50,000 or 60,000 feet as easily as present planes gain 10,000 feet.

* * *

WHILE the nations of the world are attempting to conquest the upper regions, it has been learned that the United States Biological Survey have been studying airways used in bird migrations and have discovered that birds stick to the same route for

(*Concluded on page* 394)

The Link Trainer Has Proved Practicable



This is the Link Trainer as supplied to the army.

STUDENT pilots in the Army are now doing most of their blind flying without ever leaving the ground.

A new dummy training plane, known as the Link Trainer, has been developed which teaches the fundamentals of instrument flying and "riding the radio beam" just as well as if the student were actually several thousand feet in the air.

Of course, after he has mastered this system he is given real flights in a hooded cockpit, but when used during the early stages, the new trainer is believed to produce better pilots and to do so at a substantial saving in cost.

The outfit looks just like a small airplane with wings and conventional control surfaces. The cockpit is rigged up similar to that in a full-size airplane and the student finds the same controls. A box-like hood fits down over his head and completely obscures everything outside the cockpit.

The plane can turn and bank and spin and perform other maneuvers, and the readings of the instruments are the same as if the ship were really in the air. An instructor, seated a short distance away, operates a miniature radio beacon system and the pilot of the trainer endeavors to find the beam and follow it in to a theoretical landing.

The equipment makes an automatic record of each flight and the student can see graphically just where and how he got off the course after the "flight" has been completed.

Riding on the Radio Wave Beam

COMMERCIAL airlines have, for a long time, used radio beam directors and compasses, but it is only within the last few months that practical apparatus has been developed for the private pilot at a reasonable cost and simple enough for his purpose.

In the accompanying photo is shown a radio beam instrument that is sufficiently compact to be adapted to small privately owned ships and one that can be sold at a comparatively low price. With this instrument, the pilot can "ride the beam" with perfect assurance and, at the same time, obtain directional data and weather reports with one and the same instrument.

Blind flying is perfectly possible with this instrument which, while now in the experimental stage of development will soon be put into production on a large scale and at a price commensurate with the service it peforms. It will not be long until they are required by law.

The radio navigating instrument is compact and yet capable of accurate operation.

Aviation Club Activities

In this new department, which we trust will be a permanent feature of POPULAR AVIATION, we take pleasure in presenting notices from the various aviation clubs, both in this country and abroad. P.A. will greatly appreciate letters from these clubs which will be published without cost to the membership.

THUNDERBIRD FLIGHT is the attractive and appropriate name for an aviation club located at Superior Airport, Superior, Wis. It has been in existence for two years, has an active membership of fifteen and a number of social members, the latter being mostly business men of that city.

Thunderbird Flight now has one ship, an OXX-6 Waco 10 and is negotiating the purchase of another ship in the 100 horsepower class. The club operates the Superior Airport, and aside from flight instruction, has developed a very complete ground course. Within the next few months, four club members will be eligible for private licenses and two will apply for limited commercial licenses. Jules Brent, transport pilot and licensed mechanic, is the club instructor.

The club is very active socially, numerous dances, military balls and parties providing entertainment as well as a source of income for the club. It is cooperating with the Superior Junior Chamber of Commerce and city officials in an attempt to raise funds for a new airport. As soon as funds are available, they also intend air-marking the numerous small towns lying within a radius of 100 miles of the base port in Superior.

Cliff Canfield, to whom we are indebted for this interesting information, is the club commander, H. Suneson is the lieutenant commander and W. Monberg is captain.

* * *

PAPERS of incorporation have been issued to the Darius-Girenas Aero Club, 223 Bay 31st St., Brooklyn, N. Y. This club has been formed for the purpose of promoting interest in aviation among Lithuanians in this country, according to an interesting letter received from Walter Corniskey, the vice-president.

At the present time, there are sixteen members and the club has purchased a training plane for instruction under A. Kiela at the Flushing Airport, Long Island, N. Y. Everyone is enthusiastic over the prospects of this club for aviation interest is high among the fellow countrymen of Darius and Girenas.

* * *

DAN BRADERA, Indianola, Miss., has just completed a small landing field on his farm, two miles north of Indianola. It has "T" shaped runways, 1,640 feet North and South and 1,250 feet East and West. The port is on level ground, natural drainage and with no obstructions. The field will be known as "Indianola Airport" and will be free to all visiting planes.

The club plane is the final objective of all aviation clubs. Many clubs have achieved this ambition while the others remain—hopeful.

Later, a flying club will be formed and a lightplane will be purchased for training purposes. This is really a most interesting development that should be noted by other aviation enthusiasts in communities of this size. We congratulate Mr. Bradera upon his initiative and progressive spirit.

* * *

A GLIDER CLUB has recently been formed in Morris Plains, N. J., which will be known as the Morristown Gliding Club. This club is in the market for a new or slightly used well conditioned glider. If you have such a glider, address Jack H. Merrill, Secretary, the Morristown Gliding Club, 2 Sherman Ave., Morris Plains, N. J.

* * *

DOWN in Sandusky, Ohio, a husky young aero club was formed which now has more than forty members, although it is only a few months old. This is the Sandusky Aero Club of which James F. Stockdale is president, John Heinsen is vice-president, William Hinde, secretary and Ruth Knouff is treasurer. We hear that this organization resulted from an informal talk made by Al Knouff, who described the activities of the Indianapolis Aero Club with such fervor that twenty-five pilots and students from the five counties around Sandusky, decided to start along parallel lines.

The purpose of the club, as stated in the constitution, is as follows: (1) To promote good fellowship among airmen, (2) To stimulate flying activity and interest, (3) To further safeguard the interests of individual flyers by group action, and (4) To cooperate with other organizations for the advancement of these principles. Control of the club is in the hands of active flying members who all hold some grade of license or other tangible evidence of their activities in aviation. Associate and sustaining memberships are provided for others.

Meetings are held on the first and third Thursdays of each month and visiting flyers, particularly visitors from other clubs, are always welcome. Information can be obtained at Parker Field, or from 325 W. Market st., Sandusky, Ohio.

* * *

WE HAVE mentioned the Icarian Club, Chicago, before but we again take pleasure in announcing its activities. This club, originally founded by a small group of aviation enthusiasts, is making rapid progress in the attainment of its objectives. Recently, a talk was given at the club by the veteran pilot, Ed Nelson, of the Airport and Airways Division, Pyle National Headlight Company. Ed spoke on his favorite subject, "Airplanes—Past, Present and Future."

* * *

THERE'S a West Coast organization that is full of pep and vigor. This is the organization of private pilots and amateurs known as the "Private Flyers Association of Oregon," located in the town of Eugene, Ore. From time to time we have made brief mention of this club.

Fifteen members are listed of various occupations and avocations, but all having one thing in common—intense aviation interest. They issue a very interesting monthly bulletin to the membership which is of great service, lists of planes for sale, local news items and all the rest of it. One of the want ads is quite pertinent and should be reproduced in this part of the country as well as in Oregon: "WANTED —More good weather and flying time."

The Management and Design of

Showing the layout of the runways at the Chicago Municipal Airport, one of the busiest airports in the United States.

by

E. STANTON BROWN

Commercial airlines editor of
POPULAR AVIATION

DEAR Friends and Enemies: For the past several months we have been taking a squint at the back-stage operations of airlines, and for my own part I've had a right royal time as conductor of the tour.

We've poked our noses here and there, got the good old smell of gas and oil in our nostrils, jabbed our inquisitive beaks into the pilots' "office," pestered traffic men, looked over the ships with an appraising eye, clumped around through operations hangars and followed through on the maintenance and repair of our airliners.

A lot of you have had a swell time with me and have dropped me a line saying so or raising points here and there for a bit more information or to debate a bit about. While we're on the subject, let me say that if any more of you have the urge, just grab the old pen and let's have it, pro and con, and if something has been neglected, we'll trundle around and see that the dope is dished up.

It occurred to me the other day, that all this time we have been stirring around, looking things over, we had been so interested in looking at the airlines themselves that we had passed up a mighty important point, and it has been under our noses and feet all the time. Just what, might I ask you, would an airline, or an airplane, for that matter, be without an airport?

For some reason or other, airports seem to be something people just take for granted, but yet practically all aviation activity, exclusive of manufacturing and traffic work, is centered around airports. And let me tell you, an airport just by itself is a mighty interesting thing. On the airport, its equipment, efficiency and management, depends a great portion of the safety and operation of airlines.

Maybe you didn't know it, but on February first of this year, there were 2,304 airports and landing fields in the United States and there are more now. Let's break down this number and see how it is divided into types.

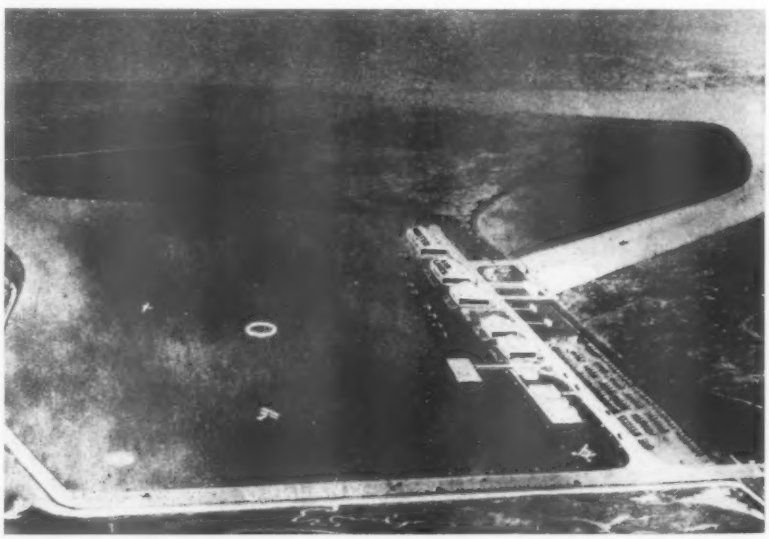
Municipal airports	705
Commercial airports	568
Department of Commerce intermediate fields	216
Army airdromes	58
Naval air stations (including Marine and Coast Guard)	24
State-operated fields	33
Marked auxiliary fields	584
Private fields	48
Fields for miscellaneous Government activity	23
Total	2,304

Airports and landing fields having any night lighting equipment.

Municipal	243
Commercial	108
Intermediate	253
Army	28
Navy	13
State	9
Auxiliary	5
Private	9
Total	668

There is a lot of careful engineering work and planning behind every airport. Problems of location in respect to the city it serves, terrain, drainage and obstacles adjacent to the field, transportation into town, electric and water supply, must first be met and solved.

Then comes the job of constructing the field itself. If the field is not properly drained by natural means, drainage systems must be laid. The soil must be seeded with a tough and hardy grass. If the field is not to have runways, the carefully prepared land-



Layout of the Oakland Airport, Oakland, Calif., which is located across the bay from San Francisco.

Airline and Private Airports

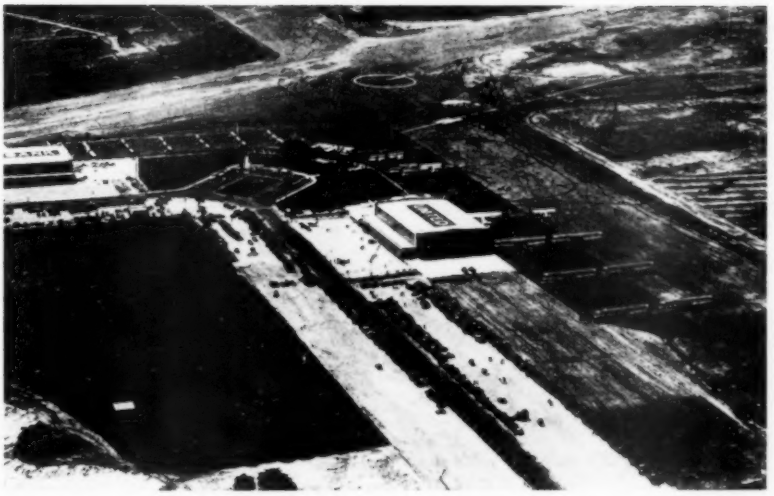
ing strips must be at least 500 feet wide and of a length proper for the type of operation to be conducted on the field, from at least 1,600 feet to 2,500. If night flying operations are to be conducted, lights marking out the landing strips or runways must be put in, flood lights, obstacle lights and beacons must be provided for. Proper buildings must be designed and constructed. All in all it is an extremely complicated and expensive procedure.

From an average of 450 airports, the cost of construction has been broken down into percentages for the various types of work and equipment installed.

Land	52.00%
Hangars	16.75%
Clearing and grading	10.05%
Administration and other buildings	4.65%
Hard surfacing	4.18%
Draining	2.94%
Shops and fire equipment	2.94%
Lighting	2.15%
Seeding	.60%
Mis. capital expenditure	3.74%

Previous to January 1, 1935, the Department of Commerce rated all landing fields according to three rating factors: (1) general equipment and facilities, (2) landing area, (3) aeronautic lighting equipment. The first symbol for rating was a letter, the second a number and the third a letter. The rating was done at the request of the field operators.

All fields had to have minimum basic requirements for rating which included a suitable field or landing area, freedom from obstructions, a good road leading into town, wind direction indicator, proper markings for field and landing area, adequate drainage, fuels supplies, communication and transportation facilities and airport personnel.



The United Airlines use the Burbank, Calif., airport shown here. This is one of the most modern ports now in use by a large airline.

The facilities and equipment the field had in addition to these basic minimum requirements determined the rating bestowed upon it. For example the highest rating, A-1-A, meant the airport was equipped and laid out as follows:

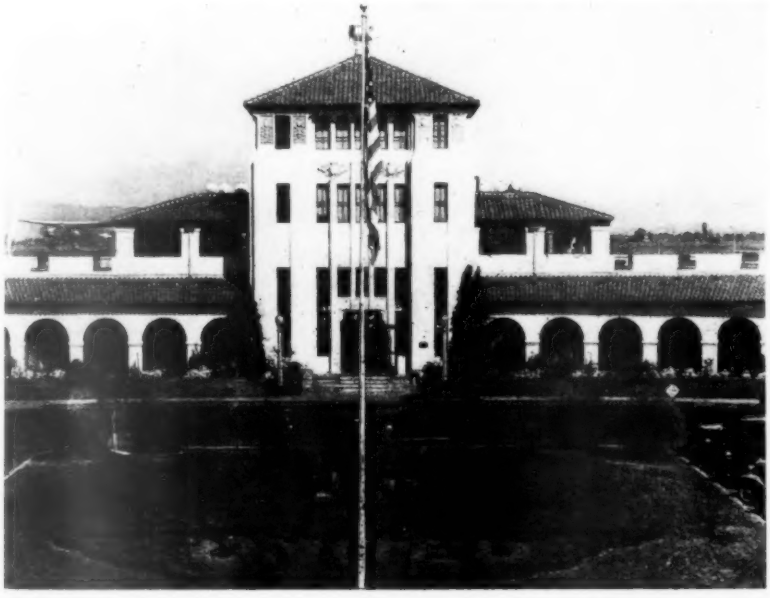
A. One or more hangars at least 80'x100', with 18 foot clearance, heated and with safe provision for heating water and oil, one or more wind indicators, adequate repair equipment, weather instruments, equipment for snow removal, first aid equipment, register of arriving and departing aircraft, firefighting equipment, adequate personnel for all services, sleeping quarters at or near field, waiting and rest rooms, and restaurant at or near field.

1. Landing area of at least 2,500 feet in all directions, with clear approaches in good condition for landing at all times. If the airport lay more than 1,000 feet above sea level, the length of landing strips or runways had to be lengthened accordingly.

A. Airport beacon with distinctive flasher for identification of airport, illuminated wind direction indicator, boundary lights, obstruction lights, hangar flood lights, ceiling projector, landing area floodlight system, all-night operation of lighting equipment and sufficient night personnel.

As an airport lacked these necessary items, it was accordingly given a lower rating. There was also an additional higher rating of A-T-A for scheduled air transport airports. This rating was based further upon facilities incidental to the operation of scheduled airlines and the handling of passengers.

On January 1, 1935 the above system of airport rating was discarded, but it is a good thing to know in order that one may fully understand the important part played by the Department of Commerce in the development of adequate airports all over the country, and to get a good grasp of an import-



The passenger terminal and administration building at United Airport, Burbank, Calif. Burbank is a suburb of Los Angeles, Calif.

ant phase of the history of the development.

Because of the great increase of the number of airports all over the country, the Department of Commerce was forced to discontinue rating all airports and to confine examinations of landing area and equipment to those airports directly concerned in scheduled airline operation. The requirements of these airports will be based only on features necessary or linked to safety of flight. Such airports from now on will be designated by a "T" classification only.

Safety is the cardinal principle of all airports, just as safety is the most important factor in all of aviation. It is the airport manager's job to see that all rules for the safe operation of the airport are adhered to, and that such improvements are made as available to increase the factor of safety. Stated briefly it doesn't appear to be much of a job, but it entails rigid law enforcement, care of visiting public, proper maintenance of the field, developing and improving the field and air traffic control.

This last function, air traffic control, provides one of the most interesting things at a field used for scheduled air transport operations, particularly a large one where the flow of traffic includes from eighty to ninety scheduled arrivals and departures each 24 hours.

The heart of the control of the air traffic in the radio control tower, usually located on the top of the administration and passenger terminal building. Picture in your mind, a glass room, all four sides and the top of glass, on top the low station. Along the three foot space from the bottom of the windows to the floor are lined a seeming endless array of radio sets, all connected to a central control panel. Each one is tuned to the wave length of a particular airline. In the upper four corners of the glass room are loud speakers. From them pours almost constantly the reports of planes contacting the airport, arriving, departing or en route to their destinations.

The air traffic control man sits calmly in the midst of the din and in some unaccountable manner keeps a wary eye on the doings of ships about the field and maintains contact with all ships reporting. Before him is a progress report on which he keeps a record of all scheduled planes and their progress to or from the city within his jurisdiction.

A blast comes from one of the speakers. "Conroy, United Air Lines 365, 2 miles South of Goshen, 9,000." Conroy, pilot of United Air Lines ship No. 365, was reporting his position as 2 miles South of Goshen, Indiana and that he was flying at 9,000 feet.

The control man jots the ship's position and time of reporting down on the log while he acknowledges receipt of the report.

"O. K. Conroy," he snaps into the transmitter. Then with a glance at an anemometer and wind vane on the roof, "The wind is 15 miles southeast, the wind is 15 miles southeast, we are using the southeast runway."

He turns to an American Airlines ship poised at the end of the runway. With one finger he presses a button which flashes a green "go" light on the top of the control tower and speaks again into the transmitter. "O. K. American 170. Take off. The air is clear behind you."

A TWA Douglas on the ramp in front of the terminal is loading its passengers and the pilot contacts the control tower. Another glance to the wind vane and anemometer. "The wind has shifted to south, TWA. Take off on the south runway."

In the meantime, the American Airlines "Condor" number 170 has just lifted her wheels from the runway. The control man's hand shoots out and punches a recorder. There are two before him, one for arrivals and one for departures. After recording the departure he notes it on his progress report together with the name of the pilot, number of plane and time of departure.

He once more reaches for the transmitter. His eagel eyes have spotted a ship to the west of the airport, barely discernible. "WGEH—WGEH —to the ship to the west of the airport. WGEH to the ship to the west of the airport. The wind is now south about ten miles. The wind is now south about ten miles." The ship is close to the airport now. "WGEH to the ship to the west of the airport. If you can hear me dip your wing."

The ship continues on and gives no sign of having heard. It swings over the field for a squint at the wind indicator. "No radio," mumbles the control man. Then to the TWA Douglas which is ready for take off. "Hold it TWA. There is a ship coming in for a landing behind you." The private plane skims in, settles and taxis down to the end of the runway. "OK TWA. Take off."

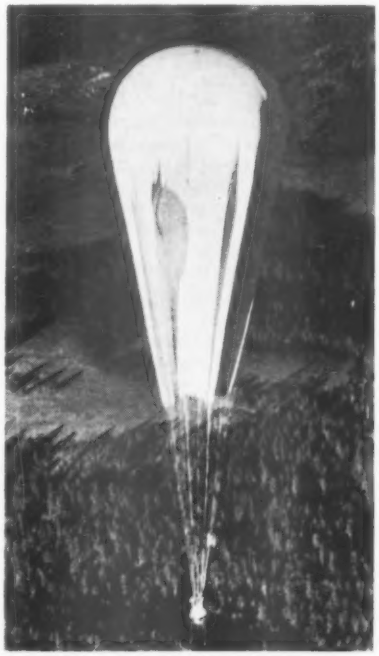
And so it goes throughout the day and night. All lights on the field are controlled by switches from the control tower, and when ships come in at night the control man gives them the flood lights.

Having started at the top of the administration building, let's go down the narrow winding iron stairs to the next floor. In this instance it is the administration building and passenger terminal of the Chicago Municipal Airport, the busiest airport in the country, and probably in the world.

The floor below is taken up with the offices of the airport manager and his assistants. Wide windows give an excellent view of the field. The next floor, the ground floor, is given over to a passenger waiting room, restaurant, wash rooms, ticket counter, telegraph offices, arrival and departure board, a large airway map of the United

(*Concluded on page* 396)

How High Will They Climb This Summer?



The take-off of the National Geographic stratospheric balloon in last year's raid on the stratosphere.

JUST what will be the fortunes of the stratospherists this summer, if it is decided to again attack the world's altitude record? Will they break Commander Settle's mark or will there be another series of annoying and expensive mishaps?

There is a great deal of talk about another stratospheric expedition this summer by a well known scientific society which has endeavored to provide against the many accidents.

The National Geographic balloon just before the take-off. Making ready for the words, "cast-off."

The Future Lightplane Engine

by GLENN D. ANGLE

PART II.

In this second article, Mr. Angle discusses cylinder arrangement and cooling systems that are most suitable for the privately owned lightplane, and the probable application of these principles in future engines.

The radial type engine has been identified with aircraft for so long that few have ever regarded its usefulness for any other purpose. In fact, until recently, the only installations worthy of attention have been air-screw propelled boats for operation on ice or water, and both types have been mostly privately-constructed boats for sporting purposes.

Obviously, this market holds no immediate promise for a great volume of engines, since so few can afford to indulge in these sports. We must direct our attention, therefore, to fields in which the demand for large numbers of internal combustion engines has become established, and naturally the automobile is the first to be considered.

The installation of an engine of radial form in any of the present-day automobiles would present no feature worthy of serious consideration; in fact, such installations may be regarded as unsuitable from almost every standpoint.

However, the picture looks quite different when considered for the automobile of the near future; that is, if we may be guided in our selection of tomorrow's automobile by the opinions of many experts who should know approaching trends. I refer, of course, to the car having the engine mounted in the rear. We cannot devote space here to ad iscussion of the features of rear-engined automobiles, but it might prove profitable to briefly point out the salient features of the radial engine as compared to other forms for such installations.

In the first place, a radial engine of a given displacement should weigh much less than an in-line or Vee type of corresponding size. This is an important feature, since the removal of the engine to the rear of the car introduces important problems in weight distribution. No doubt, the solution depends upon the ability to eliminate excess weight and, in the final analysis, can only be successful if these reductions are accomplished without decreasing strength or greatly increasing manufacturing costs.

In the second place, the radial engine occupies much less space than other types of engines of the same horsepower and, when mounted with the crankshaft axis vertical, or substantially so, it lends itself ideally to enclosure with most every form of the streamline variety.

Thirdly, such an engine mounting affords greater access for adjustments and repairs than ever has been attained in forward engine installations of the conventional style. This feature deserves special attention in view of the apparent lack of accessibility found in most of the front-end engine mountings of new cars having "so-called" streamlined body shapes.

It would be possible, of course, to enumerate many more noteworthy advantages for the proposed installation, especially if we were to deal at any length with its greater simplicity. But, there seems to be no need to dwell upon features that must become apparent almost immediately to anyone who will spend a little time in studying this problem. It should suffice to know that, at last, we have discovered a great protential market for an engine of the type and output considered most suited for light airplanes.

The "in-line" engine, while presenting small frontal area has certain inherent disadvantages.

In order to clarify the discussion up to this point, some comments as regards the type of cooling system to be used are in order. While the radial engine for aircraft should be directly air cooled—for reasons generally understood—it does not follow necessarily that a radial engine for automobiles must be constructed along identical lines.

The simplicity of the air-cooled system certainly commands consideration, and we know that it can be adapted without serious difficulty to this new application. However, should it appear advisable in certain instances to avoid some of the possible disadvantages of air cooling for such installations, the water circulating system may be resorted to the same as in the case of any conventional in-line or Vee engine for automobiles.

To combine the principal advantages of both systems, one may use a non-circulating system with a coolant having a higher boiling point than water, and dissipate the heat by circulating air over cooling fins that have been provided on the outside of the cylinder jackets. Besides eliminating the radiator and piping, it should become possible to develop a cooling system that will maintain an optimum cylinder temperature and insure satisfactory valve cooling under a wide range of conditions, as well as avoid some of the attendant troubles that are quite common with each of these systems as they are used at the present time.

With the assumption that the foregoing comments have explained with sufficient clarity the possibilities for the radial type engine in this new field, we now may turn our attention to the economic phase of this proposal. Naturally the reader is ready to ask how one may adapt (to aircraft) an engine that is designed and built especially for mounting in the rear end of an automobile.

For obvious reasons, I do not propose using identical engines for both installations. The manner of mounting alone would involve alterations in the lubricating and induction systems. The driving end of the crankshaft, as well as the end cases, could not be made the same in every instance. Even the cylinders and the valve mechanism might need some revisions to meet the differences in operating conditions.

However, there are many parts that can be made interchangeable, and the others—with few exceptions—can be produced from the same manufacturing and tooling equipment. Herein lies the production economy which I firmly believe is necessary before we really can expect to have a low-priced aircraft engine.

I understand that it was suggested to convert an automobile engine for the $700 light airplane proposed by the Department of Commerce, and—in all probability—there were many who, at first, thought this to be a feasible scheme. While it does parallel the ideas which have just been expressed, the plan in itself falls far short of accomplishing the desired result.

It would require several paragraphs to deal with all the pros and cons of this particular plan, so I hope that it

will suffice to merely direct attention to the fact that the type and form of construction of present-day automobile engines, as well as their weight, makes them quite unsuited for the purpose. The several attempts to convert automobile and motorcycle engines for aircraft installation in the past should furnish ample proof that the engineering and economic considerations of this procedure are rather barren of possibilities.

The author does not claim or wish to imply originality in all the ideas that have been presented. Therefore, it should be explained that this article was prepared primarily with a view toward passing on the results of a rather thorough analysis of this problem which was made some time ago.

This included the preparation of several designs, in which both automobile and aircraft installations were studied simultaneously, and the weights and manufacturing costs carefully estimated. While the designing problems are naturally more complex than in a single-purpose engine, most all can be solved in a satisfactory manner, and a wide range of interchangeability of parts be secured.

It seems reasonable to expect that the proposed engine to serve this dual purpose will either originate or be sponsored by the manufacturer using it in greatest numbers. In this event, the lightplane builder must await the development of the rear-engined car, as well as the acknowledgment and acceptance of the radial engine as the most desirable type for automobiles of this class.

Naturally, most automobile manufacturers will endeavor to follow present types in the first cars which they build with engines at the rear. It would appear to be sound manufacturing economy to utilize existing tools and equipment as far as possible. Furthermore, motor-car manufacturers are usually timid about introducing a number of radical design changes in a new model, and therefore may wish to learn the public reaction to rear-engined cars before spending the time to develop another type of power plant.

Then, too, the mere lack of precedence in the design and manufacture of the radial-type engine may cause some of them to hesitate before taking it up in earnest. It is in such instances that the aircraft man, having experience along these lines, may render valuable assistance—and—unless the ideas expressed here are fundamentally unsound—he is certain to indirectly help the industry which he represents.

In conclusion, let us once more briefly consider the two possible courses which may be followed in securing the ideal aircraft engine for that low-priced airplane.

The development of a new design—so simple in construction that it can be built in small numbers at low cost—is always foremost in the minds of everyone concerned with this problem. Such an engine may appear some day, but I expect there are many like myself who will become convinced of this fact only after it has been physically demonstrated. There have been so many experimental engines or designs on paper, which promised to fill such an order, that one cannot afford to be swayed by the enthusiasm of their creators. Besides, engine designers have been attempting to get these results for over twenty-five years.

It seems more reasonable to expect quicker results if we follow a procedure that has worked so marvelously well in a closely allied industry. Why shouldn't the aircraft builder look toward the automobile manufacturer, with his volume production, for those low-priced engines? Have not many features developed for aircraft—such as streamlined body forms, weight reduction, welded-tube construction and low-pressure tires—been adopted freely by motor-car manufacturers? Anyway, this is not an unfair return for the engineering development represented in the particular type of engine so ideally suited for these rear-engined automobiles of the very near future.

END.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-57

Brake-test. A test made to determine the actual power or torque developed by an engine or motor.

Bras (French). Crank.

Brass. (1) An ALLOY or composite metal consisting of copper, zinc and lead. It may be hardened by the addition of a small amount of tin. (2) See BEARING LINERS.

Brass (Annealed). Sheet, tubular or rod brass softened by heating and quenching the hard rolled brass.

Brass (Brazing). A brass used for soldering steel, iron or similar parts together. The spelter is melted by a torch over the surfaces to be joined. See BRAZING.

Brass (High). Brass containing a high percentage of zinc, also known as "hard brass." It contains from 33 to 36 percent zinc.

Brass (Low). Brass containing a low percentage of zinc. 19 to 22 percent zinc.

Brass (Sheet). Sheet brass is produced by the rolling process which hardens the material. In this form it is known as "hard-rolled." It can be softened by ANNEALING into various grades, quarter-hard, half-hard, extra hard and spring brass.

Braze. The process of uniting two metal bodies by the application of a third body in a molten state, the third body usually being a film of soft BRASS. The steel surfaces to be united are cleaned and then dusted with a FLUX for preventing oxidation of the surfaces, the flux usually being borax or boric acid. The brass is then strongly heated and the melted brass runs into the various portions, binding the parts together. This is also often referred to as BRASS SOLDERING.

Breaker (Circuit). (1) A switching device, usually automatic, that opens and closes an electrical circuit allowing the current to flow intermittently. (2) More commonly, an automatic switch in the primary circuit of an ignition system which opens the circuit at the instant that the spark is required. Also known as a TIMER.

Breaker-gap. The distance or opening between breaker contacts when in the fully opened position.

Breaker-points. The contact points of a CIRCUIT BREAKER.

Breaker (Primary). An automatic BREAKER or switch in the primary circuit of an ignition system that opens the primary circuit at the time that the spark is required.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-58

Breaker-strip. A fabric strip in a tire employed for the protection of the carcass.

Breaker Timing. The time at which the BREAKER of an ignition system opens and causes the ignition spark. This is in terms of the piston position of the engine —ADVANCED when taking place before the end of the compression stroke and RETARDED when taking place after the end of the compression stroke.

Breather. (1) Any opening which permits the inhaling and exhaling of air or gas. (2) The movement of a flexible surface that corresponds to the breathing of the lungs.

Breather-tube. An opening or passage in the crankcase of an engine which maintains the interior pressure at atmospheric pressure. It connects the interior of the crankcase with the external air so that air flows back and forth through the tubes when the engine is running. Is usually connected with a DUST SEPARATOR.

Breeze. A moderately brisk wind.

Breeze (Fresh). A wind marked (5) on the BEAUFORT SCALE, or about 8.8 meters per second.

Breeze (Light). A wind measuring (2) on the BEAUFORT SCALE or about 3.1 meters per second.

Breeze (Moderate). A wind marked (4) on the BEAUFORT SCALE, or about 6.7 meters per second.

Breeze (Strong). Also "Stiff breeze." A wind marked (6) on the BEAUFORT SCALE or about 10.7 meters per second.

Breguet (Louis). An early French experimenter in aeronautics and the constructor of many famous military planes during the World War.

Breguet Formula. A mathematical rule or formula for determining the flight distance or RANGE of an airplane from the weights, lift-drag ratios and the fuel consumption of the engine.

Bremse (German). Brake.

Brg. Abbrev. BEARING.

Bridge. (1) To cross over. (2) To cross over or jump certain parts of an electrical circuit when making a connection.

Tests With a Noise Analyzer

How the Engineers of the Westinghouse Research Laboratories determined the relative noise made by various vehicles with a new instrument known as a "Noise Analyzer."

ENGINEERING history was made as a result of diagnosing the noise of an airplane in flight, speeding trains, street cars and buses.

The actual tests were made in a high speed airliner of the General Aviation Manufacturing Corporation, Pullmans and coaches of Pennsylvania Railroad trains, street cars of the Pittsburgh Railways Company, and in buses of the Pittsburgh Motor Coach Company, by means of an ingenious portable noise analyzer just developed in Westinghouse Research Laboratories.

Although airliners, railroad coaches and Pullmans have often been tested for loudness or total noise, never before have these noises been analyzed to find out what percentage of the noise is in the low frequency band, how much is in the high frequency band, at what frequencies peaks of noise occur and other important information that will enable engineers to eliminate causes of the noise at their source.

In making the tests, total noise readings and analysis reading were taken for various rates of speed and for various rates of speed and for various conditions, such as rough air and smooth air in the case of the plane; terminal track, open country track and tunnels in the train tests; paved street city track and open country track for the street car; and suburban boulevard and downtown city traffic for the bus.

The total loudness readings checked the findings of other investigators who have studied noise from that standpoint. Stated in decibels, the standard unit of sound, results were:

MEDIA	SPEED Mph.	LOUDNESS IN DECIBELS Min.	Max.
Railroad Pullman	45	68	74
DeLuxe Transcontinental Bus	40	74	79
Railroad Coach	35	75	80
Transport Airliner*	190	77	81
City Bus	30	78	84
Street Car* special gears	35	81	83
Street Car** Conventional type	35	85	88

**Unfinished plane, sound insulation incomplete.*

***Experimental car, helical cut gears.*

Perfect sound-proofing has made entertainment possible on the TWA "Luxury Liner." Courtesy of Metropolitan News Photos.

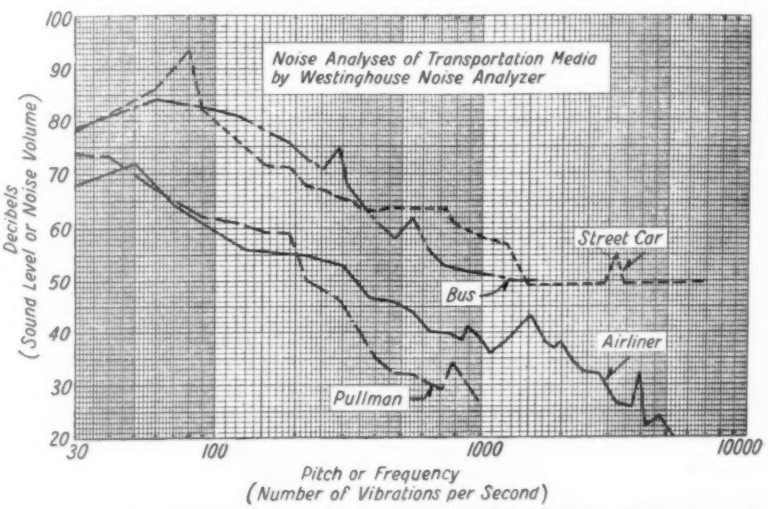
That the total loudness readings do not tell the whole story is evident when they are compared with the results of the analysis. The accompanying chart gives a graphic picture of the noise analyses of four vehicles: (1) a conventional low floor type of Pittsburgh Railways Company street car, (2) a Fageol Twin Coach of the Pittsburgh Motor Coach Company, (3) a GA-43 airliner of the General Aviation Manufacturing Corporation, and (4) a Pullman parlor car on a Pennsylvania Railroad train.

The chart shows that in each of the four vehicles, the low frequency sources of noise are much more intense than the high frequency sources. In the cases of the airliner and the Pullman the high frequency noises dropped below 25 decibels which is equivalent to the noise of a cat purring.

In the cases of the street car and bus, the intensity curves, although higher in value, follow a pattern similar to those of the airliner and pullman with a downward slope through the low and medium frequencies, but where the curves for the latter two continue to decline in the high frequency band, the street car and bus curves flatten out. Osbon attributes this fact to the presence of high frequency gear noises in the street car and to window rattle and similar impact noises in the bus.

The numerous sharp peaks which occur in each of the curves indicate sources of loud noise at frequencies corresponding to the peaks. By tracing the causes of such noise sources and eliminating as much as possible

(*Concluded on page* 395)



A graph showing the comparative noise made by various vehicles in terms of audibility and pitch.

Laying Out Tapered Wings

by WALTER H. KORFF

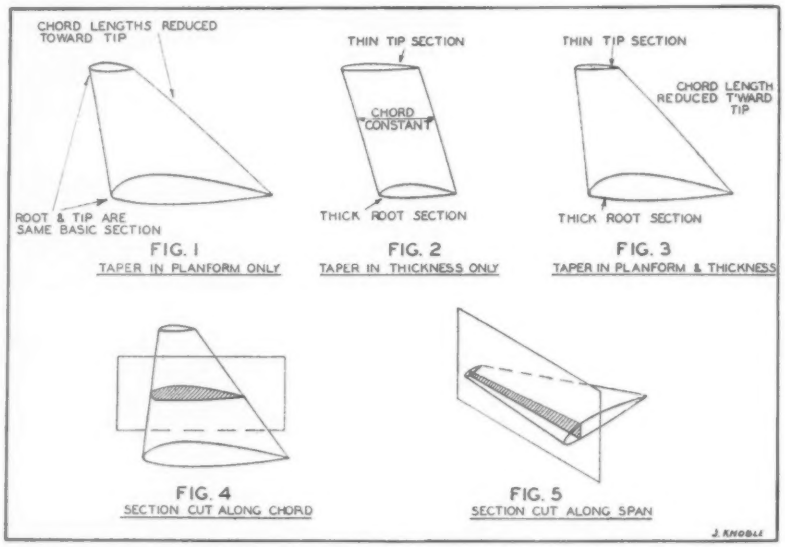
A simple method of solving a complex problem is shown by the author, a problem that has often baffled amateur plane builders and designers.

LIGHTPLANE builders are now at the point where they are ready to accept tapered wings for their designs, but often the big problem is not the matter of materials or details but rather the layout of the wing.

Each wing section is different for each rib. Model builders are also facing this same problem because the latest designs almost always have tapered wings.

It is, therefore, the purpose of this article to present a practical but accurate way to develop sections for tapered wings, and every effort will be made to make it easy to understand.

First, it might be well to review the three kinds of taper. A wing may be: (1) tapered in planform only; (2) be tapered in thickness only; (3) be tapered in both planform and thickness. See Figs. 1-2-3. The method of layout to be used is essentially the same for each kind of taper. As most modern designs taper the wings in both planform and thickness we will use such a wing for our example.



Showing the elements of the tapered wing that is tapered in plan-form, thickness and plan-form thickness. The varying rib form and dimensions are clearly indicated.

SECTIONS

We are all familiar with wing sections cut along the chord of a wing as shown in Fig. 4 but it will also be necessary to cut sections along the span. See Fig. 5.

PROCEDURE

In the layout of our tapered wing, the first step will be to lay out the root section and tip section. From these sections all intermediate sections can be found. For our example the root section will be the Clark Y-18. The tip section will be the Clark Y-unmodified.

It will be recalled that the Clark Y-18 has a maximum thickness of 18 percent. The Clark Y, unmodified (our tip section), has a thickness of 11.70 percent. The wing will taper in planform, from 78 in. at the root to 24 in. at the tip.

After the root section and tip section are laid out, we are ready for the development of the intermediate sections. A plan view and front view of the wing will be needed now.

With the sections full size it is apparent that the plan view and front view would be quite large. To avoid this foreshorten these two views. By foreshortening we mean use a smaller scale for the semi-span only.

In our Figs. 6 and 7, it will be noticed the sections are scaled 1″ = 1, while the semi-span is foreshortened to ¾″ = 1′. First, locate the root section. Then, at the proper semi-span distance, locate the tip chord. In our example, the semi-span was made 20 ft. The tip section may be located to give any desired sweepback, in the example though it was placed so that 30 percent. of the tip section was in a straight line with 30 percent. of the root section so that a straight single spar could be used, placed of course at 30 percent.

No section will be altered, regardless of the amount of sweepback used, so for developing intermediate sections it doesn't matter what angle of sweepback is used.

Next, space the intermediate reference lines, at your chosen distances, along the semi-span, usually 12 in. apart. As you will note, only four intermediate sections are used in our example. The principle is the same with any number of intermediate sections.

From these intermediate reference lines, you can build up the upper and lower chords just as the root and tip sections were developed. This can be done quickly as follows.

To locate the vertical ordinate lines, connect the corresponding points of the root and tip sections as shown in Fig. 6. Then construct vertical lines at these points on the intermediate reference lines as in Fig. 6. We are now ready to locate points on these vertical lines to develop the upper and lower chords.

The front view is used now.

You will recall how a section may be cut along the span as in Fig. 5; that is what we will do now. At the root section, locate the first point of the upper chord; also the corresponding point of the tip section. Now connect these points with a straight line and where this straight line crosses the vertical lines of the intermediate sections we have points for the vertical distances of each intermediate section. (See Fig. 7.) Next take these vertical distances, just found, and with your dividers locate them in the plan view on the corresponding sections. (That is vertically from the reference line for the corresponding section.)

Do this with each point for the upper chord. The lower chord is then done the same way. To avoid getting so many points so close together on one front view construct a second front view for all points to the rear of the 30 percent. line.

All the points are shown in the two front views of Fig. 8. The completed planview with all the intermediate sections developed is shown in Fig. 9.

At first thought this may seem a tedious and long process difficult to follow. On the contrary the author has often made similar layouts in about four hours. In just a short while after starting your layout you will see how easy it becomes since much work is often repeated and soon becomes second nature to you.

Even though the job entails more work than the construction of uniform wings, the improved efficiency and flying characteristics of the tapered wing will be more than a sufficient reward for the greater effort. The tapered wing is far the superior type.

END.

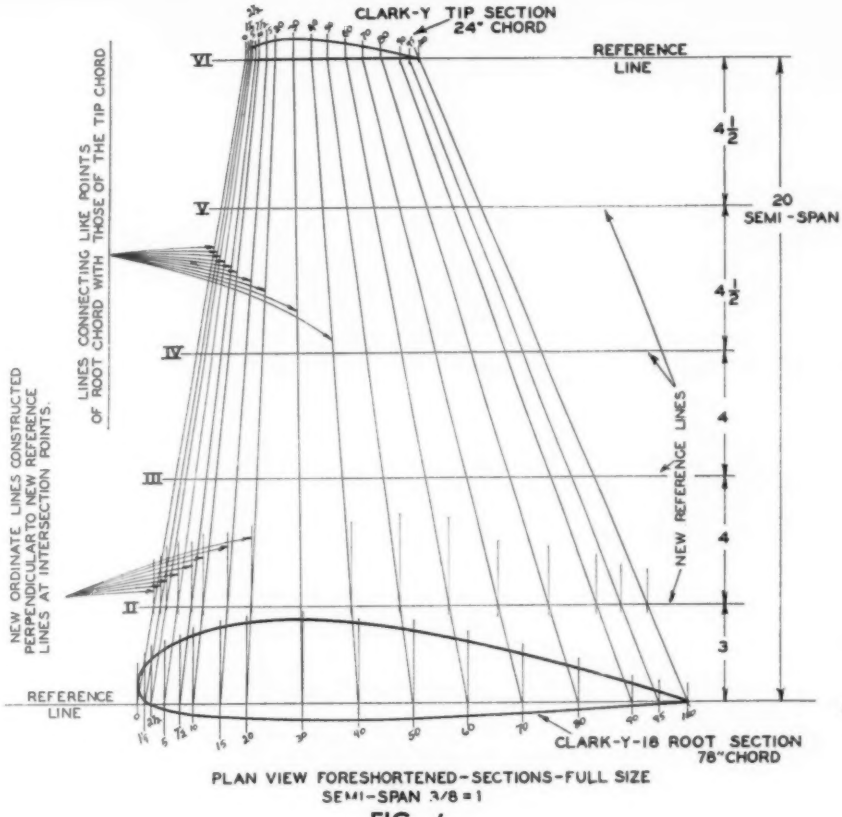

CLARK-Y TIP SECTION
24" CHORD
REFERENCE LINE
20
SEMI-SPAN
NEW REFERENCE LINES
LINES CONNECTING LIKE POINTS OF ROOT CHORD WITH THOSE OF THE TIP CHORD
NEW ORDINATE LINES CONSTRUCTED PERPENDICULAR TO NEW REFERENCE LINES AT INTERSECTION POINTS.
REFERENCE LINE
CLARK-Y-18 ROOT SECTION
78" CHORD
PLAN VIEW FORESHORTENED-SECTIONS-FULL SIZE
SEMI-SPAN 3/8 = 1

FIG. 6

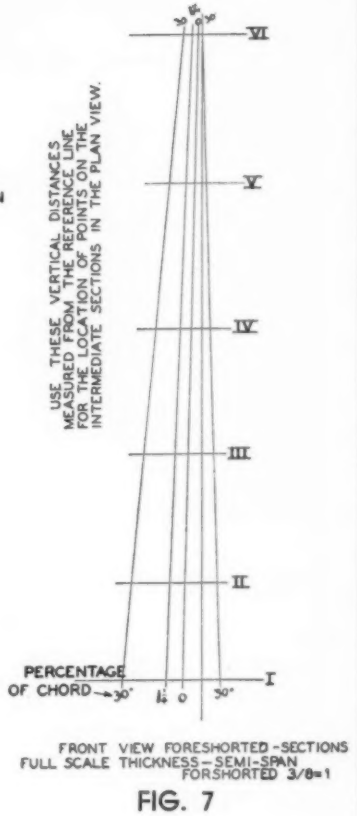

USE THESE VERTICAL DISTANCES MEASURED FROM THE REFERENCE LINE FOR THE LOCATION OF POINTS ON THE INTERMEDIATE SECTIONS IN THE PLAN VIEW.
PERCENTAGE OF CHORD
FRONT VIEW FORESHORTED-SECTIONS
FULL SCALE THICKNESS-SEMI-SPAN
FORSHORTED 3/8=1

FIG. 7

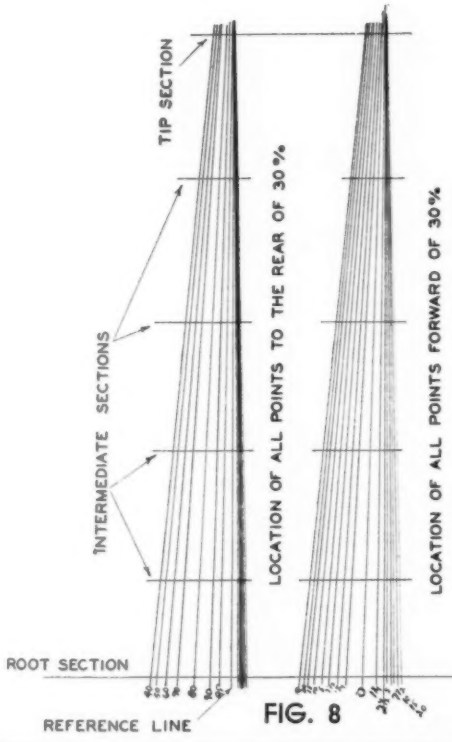

TIP SECTION
INTERMEDIATE SECTIONS
LOCATION OF ALL POINTS TO THE REAR OF 30 %
LOCATION OF ALL POINTS FORWARD OF 30%
ROOT SECTION
REFERENCE LINE

FIG. 8

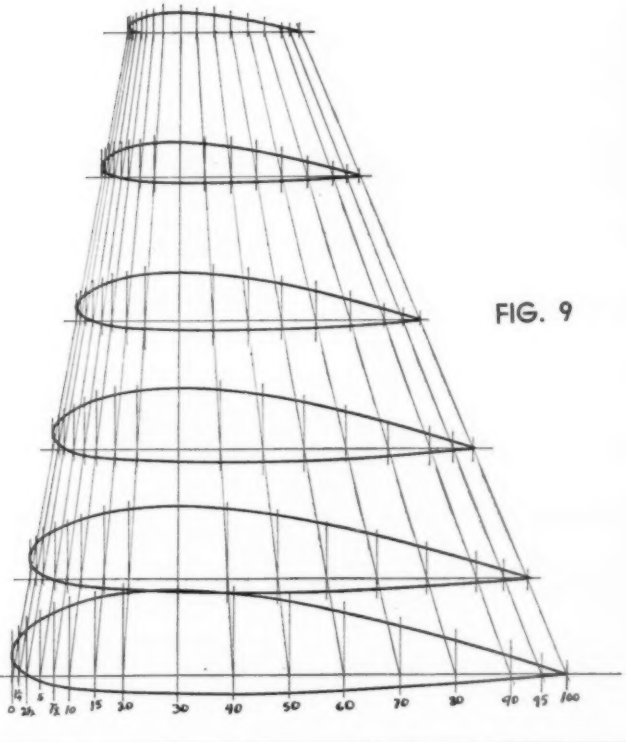
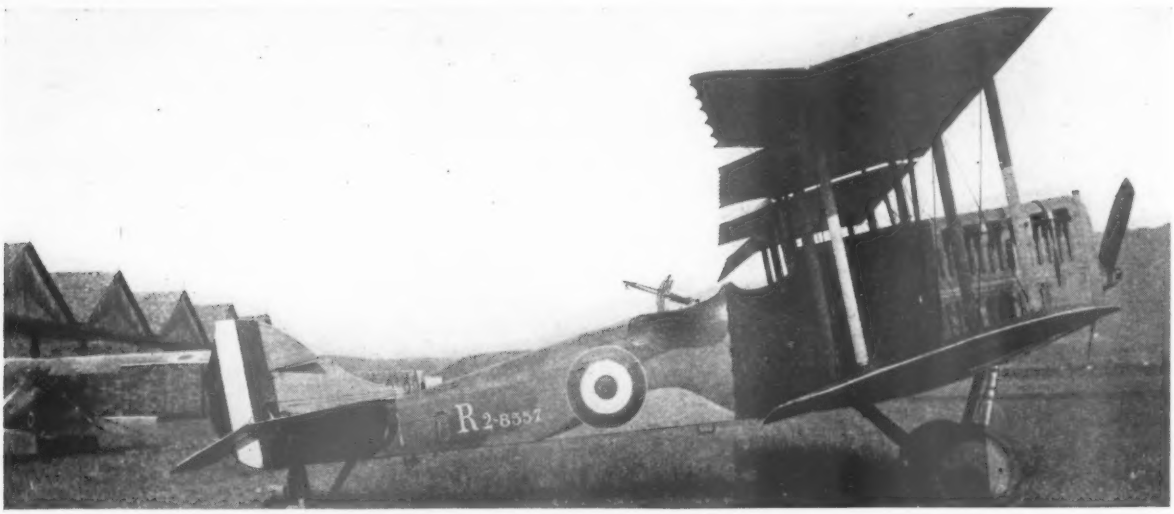


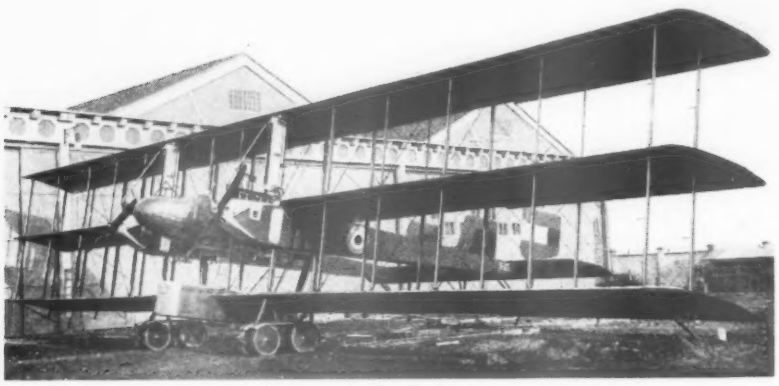
FIG. 9

Problems for Our Photo Phans

Yes, this is a Nieuport, all right, but what Nieuport? There has been a lot of argument over this picture. What is your opinion—or guess?



And here we have another mystery that has nearly led to a riot among our collectors. Yes, they are agreed upon the name but what is the type?



Is this the first or second Caproni triplane? Or, was there a second Caproni triplane?

HERE are three photographs of three World War planes that have caused all sorts of arguments and near battles in the offices of POPULAR AVIATION. We wish that you would send in your opinion or guess.

Now, at first glance, they look like the regular models and types that have been repeatedly published in P. A., but a close scrutiny will disclose the fact that they are not the standard regulation types that have been printed with every war story. They are different and how they are different.

Notes on Lightplane Props

by C. A. LORENZEN

Many pertinent remarks on the performance of propellers by a nationally known designer and builder of propellers who specializes on lightplane equipment.

IT seems that there has been very little said about the importance of the propeller in connection with the success or failure of the airplane of today, especially in the case of the Home-Builder.

It is the purpose of this article to point out a few facts, as well as to give some information to the Home-Builder as to just what difference a propeller will make, when used on the same motor but in two different airplanes.

The propeller is the unit which transmits the power of the engine into moving force for the airplane, and it can be readily seen that, since it plays such an important part, it must be built specially for each different airplane and engine combination.

Slight variations in diameter and pitch make a big difference in the performance of the airplane, and for this reason adjustable and controllable pitch propellers are becoming quite popular. However, the cost of such a propeller would in many cases exceed the cost of an entire sportplane, so for that reason they are out of the question on small planes.

Next, Mr. Home-Builder says, "What am I to do? I want my airplane to fly its best." The answer is very simple. In order to get the most out of your airplane, it must have a propeller that has been designed and built for it. This may cost a dollar or two more than a stock propeller, but the extra performance you are getting from it is many times worth this cost.

For example, you wouldn't think of buying an inner tube intended for use on a Model T Ford for a Lincoln tire, even though it might work and get you by. And for that same reason, you should not be satisfied with any propeller just because it turns out in front of your airplane and stirs up the air.

When the airplane manufacturer brings out a new airplane, he does not choose a propeller to fit the kind of motor he has installed in his new creation, and then be satisfied. But instead, he makes contact with the propeller maker, tells the whole inside story of his new model and what he hopes it will do, such as cruising speed, top speed, performance, and climb, as well as the R.P.M. which he would like to run the motor.

All these important factors are dependent on the propeller, and it is then up to the propeller manufacturer to design one which will satisfy these factors as nearly as possible.

The Home-Builder may put himself in this same class, as he in most cases has an airplane of a modified design to suit his own taste, and therefore will need a special propeller. After the airplane has been sized up, it is put in one of three classes: First, High Performing (quick take-off and good climb); second, Racing (high speed, climb and take-off not so important); and third, a Combination of one and two (incorporating quick take-off, fair climb, and medium high speed). No doubt most home-built planes will come under the third class.

A propeller for use on a High Performing airplane has a large diameter and low pitch. The large diameter gives more pulling power at low speeds in M.P.H.; thus the airplane will be set into action quicker and the result is the take-off is rapid with a very good climb. Next comes the Racing airplane with a motor which is tuned up to the 'nth' degree, and the motor running wide open 200 to 500 R.P.M. above the rated speed to get extra horsepower. This plane will need a propeller just the opposite from the above described. Its diameter will be small to allow the motor to turn up fast, and a very high pitch to give it the top speed hoped for.

An airplane with this type of propeller will require a much longer run for take-off and the climbing angle will be comparatively flat. However, after it is in motion and gained its speed, the airplane will fly nicely.

The average propeller for sportplane use might be called a "combination propeller," since it should incorporate quick take-off, fair climb, and reasonable top speed. This is obtained by balancing the diameter and pitch with the airplane and the power it has.

It has been noted that a number of Home Builders have too much faith in a new born airplane, and expect the propeller to make it fly like a dart. This is a bad attitude to take, and it should be remembered that most Home Built airplanes are not pursuit planes, since they lack the strength in design and the power to give them such performance.

After designing and building propellers for amateurs for a number of years, it is almost a known fact that the Home Built airplanes are quite heavy and usually underpowered, and for this reason a propeller with a large diameter and low pitch will work out much better. A small diameter and high pitch propeller will make such a plane struggle along at almost full throttle, and also be dangerous to fly.

A study of the table on this page will show how various propellers have worked out in actual practice when used on different airplanes; and at the same time explain why different airplanes using the same motor will need a special designed propeller to get the most out of them.

(*Concluded on page* 404)

Propeller designed for Corben Junior Ace (2 place), having a diameter of 6' 4" and 3' pitch, for use on the Salmson AD-9 motor:

Airplane	Motor	R.P.M. on Ground	R.P.M. in Air	Top Speed	Cruising Speed	Remarks
Corben Jr. Ace (2 pl.)	Salmson AD-9	1800	2000	90 MPH	75 MPH	Take-off good; climb good
Corben Baby Ace (1 pl.)	Salmson AD-9	1800	2200	100 MPH	85 MPH	Take-off good; climb good

Propeller designed for Taylor Cub (2 place), having a diameter of 5' 6" and 2' 3" pitch, for use on the Continental A-40 motor:

Airplane	Motor	R.P.M. on Ground	R.P.M. in Air	Top Speed	Cruising Speed	Remarks
Taylor Cub (2 place)	Cont. A-40	2250	2550	70 MPH	60 MPH	Take-off good; climb fair
Heath Parasol (1 place)	Cont. A-40	2250	2900	85 MPH	65 MPH	Take-off good; climb good

Propeller designed for Skippy Racer (1 place), having a diameter of 4' 5" and 3' 9" pitch, for use on Rasmussen Special 4 cylinder inverted motor:

Airplane	Motor	R.P.M. on Ground	R.P.M. in Air	Top Speed	Cruising Speed	Remarks
Skippy Racer (1 place)	Rasmussen Special	2450	2800	120 MPH	95 MPH	Take-off good; climb fair
Heath Parasol (1 place)	Rasmussen Special	2450	2525	85 MPH	65 MPH	Take-off fair; climb poor

Building the Corben Super-Ace

by O. G. CORBEN

The sixth construction article telling how to build a fine little Ford powered lightplane which has given excellent performance in its flight tests.

LISTEN, sportplane fans, and you shall hear, How to build the Super-Ace landing-gear. Not so hot, but after all, I had to have some way to start this thing off.

As I mentioned, in one of my first articles, this writing business is somewhat out of my line but I hope that you fellows can bear up under my efforts. After all is said and done, I guess there are a few who are standing by, just waiting for the next month's plans of the Super-Ace, judging from some of the fine letters I receive.

During the elapsed time since the last article, the Super-Ace has been gracing the skies around Madison and doing her stuff in great shape. I am only too pleased to report that both the ship and the motor are living up to our expectations in every respect. Quite a number of POPULAR AVIATION readers have come to Madison, via car, motorcycle, bus, hitch-hiking and every other means of travel, to get a first-hand look at the Super-Ace and to date, everyone who has seen the little job do its stuff, will verify everything that I have claimed for the ship and motor, and they leave satisfied that they will not be wasting their time by building a Ford powered job.

Strange as it may seem, most of the fellows who wander around this way, are very much in doubt, as to whether I am off my center of gravity, or if I have taken several first prizes in fish story contests, for they come shying up with a somewhat doubtful look in their eyes and ask whether they could see this Ford powered ship, I have been raving about. Naturally, like a proud father of twins, I take pride in showing off the little bus and even make excuses that it looks much better when it has some of the dust removed.

After admitting that the ship looks just like the pictures, they ask to see her fly. Nine times out of ten the tone of their voice leads one to believe they are not sure about the whole affair and again it is a pleasure to prove what I myself thought was impossible, and with my 185 lbs. seated in the cockpit, off goes the little craft after a short run and climbs like a pursuit job.

Owing to the fact that I get a kick out of flying the Super, I guess that I give them their money's worth, for upon landing, I find my doubtful visitor's faces covered with broad grins and they break down and confess that they got the surprise of their life, and another sportplane fan has been converted to the belief that the old Ford motor is every bit as good in the air as on the ground. So if any of you are in doubts and want to be convinced, just drop around this way.

The trim little Ford-motored Corben Super-Ace looks like a pursuit job and is not far from performing like one. And, best of all, it has real flying ability as well as good looks.

Every time I fly the Super-Ace I like it better, not because I designed it but for the way the little job handles and performs. The motor just can't be beat, for it is as smooth a running engine as ever pulled a plane through the air. To date, all we have had to do to keep the motor running, is to put gas and oil in it, and not so much of that. However, don't wait for that time for three gallons of regular automobile gas an hour won't break you.

It would be an easy matter for me to sit here and spiel off several pages on how good the ship flies and how nice the motor runs but that would not be much good to you in regard to helping you get your Super-Ace into the air, so I will swing around and tell you some more about the construction details.

As you have guessed from the poetic beginning of this outburst, the landing gear is the subject for this installment along with the plans for the controls.

The landing-gear used on the Super-Ace has proven to be a very sturdy one. The shock-struts are simple to construct and have very good shock absorbing qualities. They require no attention and there is nothing on them to get out of order. They are of our own design and work fully on springs. These springs are so arranged that there is no rebound on landings and at the same time they absorb all the roughness of taxi-ing over rough fields. You will find that they are very easy to build up. However, there are a few points which I will bring out and no doubt save you some trouble.

To start the construction of the struts, cut all of the tubes to the lengths shown, make up the washers as called for before you do any welding. Next, weld the small tube bearings into the ends of the top and bottom pieces of the strut. These tubes are then gusseted as detailed.

Now, weld the small washer on the top of the bottom strut tube (this washer rides on the bottom of the small spring), file the weld so it will slide into the 1-in. top tube. Weld the washer on the top tube after which the large 2-in. tube is welded to the washer.

The next step is to slip the bottom washer onto the lower tube strut. (This is the washer that later welds to the bottom of the large tube and seals the strut.) The washer which welds to the bottom tube is then welded in place as detailed.

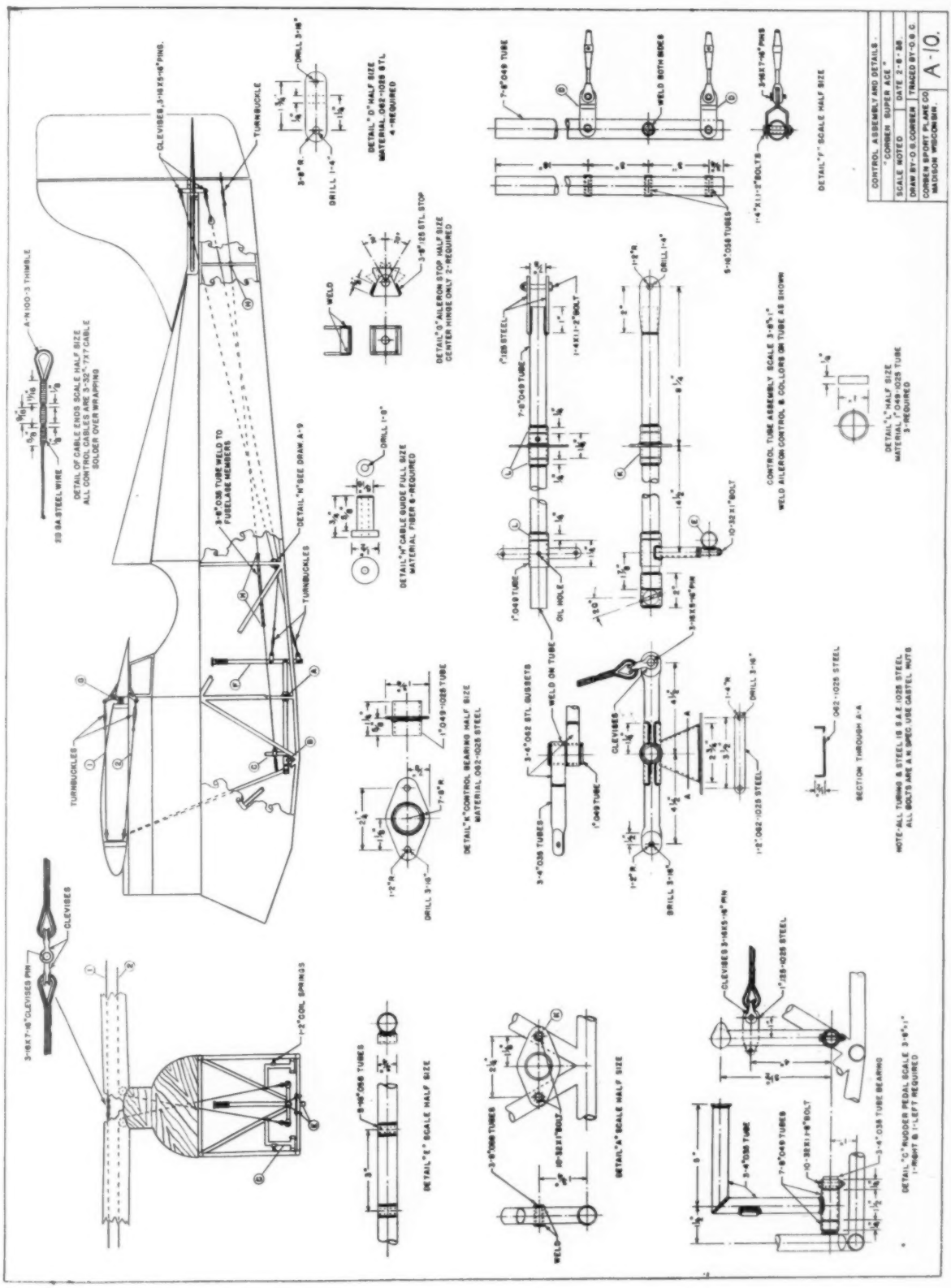
Now, put the small spring in place, then the large one. The lower strut is then assembled into the top half of the strut containing the springs, and your strut is ready to seal up. In order to weld the bottom washer to the large tube, it is necessary to compress the strut in a clamp or vise so the spring will be away from the heat of the weld.

Compress the strut to its full length and weld the washer to the outside tube, let the weld cool before taking the strut out of compression. The same applies to both struts and when they are completed give them a coat of rust proof paint and set them aside.

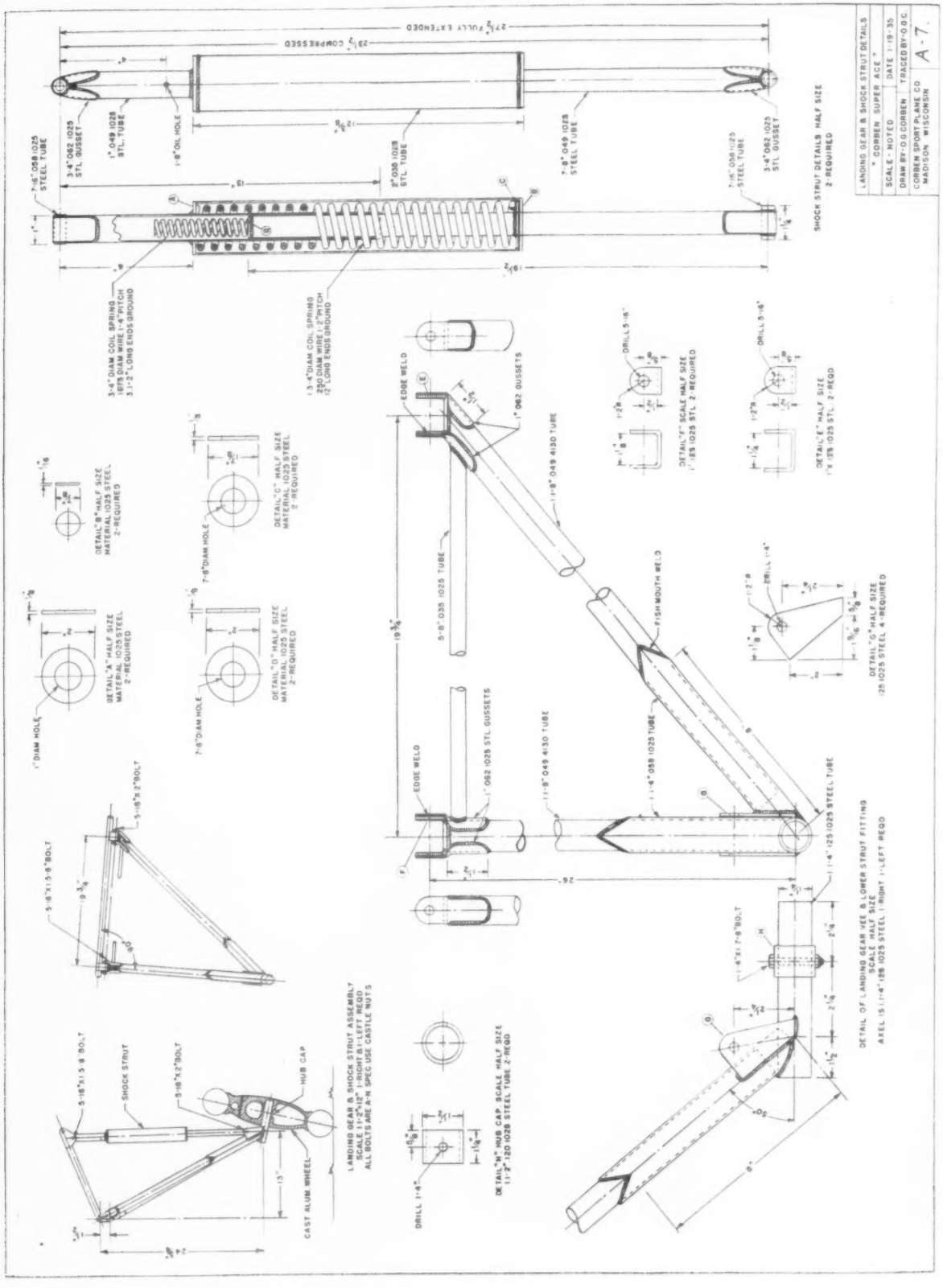
The landing gear comes next and there is very little that needs to be said about its construction, as I feel that it is very well explained on the drawing. Care should be taken to see

(*Concluded on page* 393)

Control Details for the Super-Ace



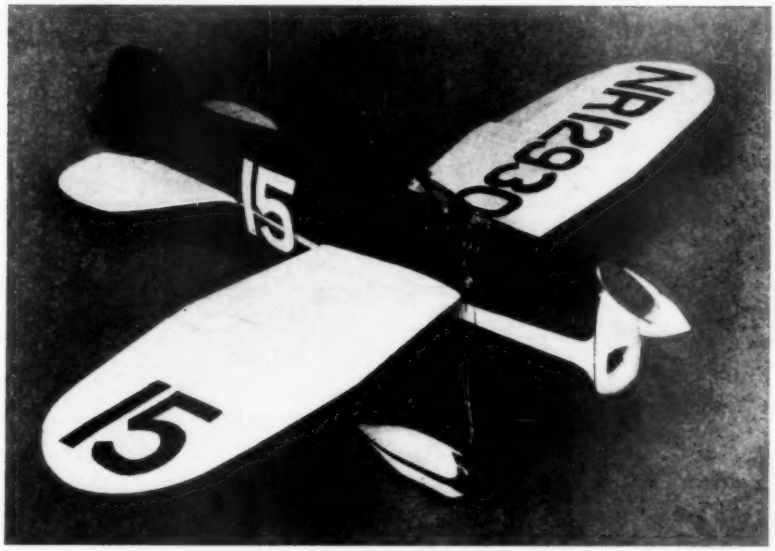
Landing Gear for the Super-Ace


LANDING GEAR & SHOCK STRUT DETAILS
"CORBEN SUPER ACE"
SCALE - NOTED
DATE 1-19-35
DRAW BY-O.G.CORBEN
TRACED BY-O.G.C
CORBEN SPORT PLANE CO
MADISON WISCONSIN
A-7.
SHOCK STRUT DETAILS HALF SIZE
2-REQUIRED
DETAIL OF LANDING GEAR VEE & LOWER STRUT FITTING
SCALE HALF SIZE
AXEL IS 1-4"-18S 1025 STEEL 1-RIGHT 1-LEFT REQD
LANDING GEAR & SHOCK STRUT ASSEMBLY
SCALE 1"=2"-2"-1-RIGHT & 1-LEFT REQD
ALL BOLTS ARE A-N SPEC USE CASTLE NUTS
DETAIL "H" HUB CAP SCALE HALF SIZE
1-2"-120 1025 STEEL TUBE 2 REQD
DETAIL "A" HALF SIZE MATERIAL 1025 STEEL 2-REQUIRED
DETAIL "B" HALF SIZE MATERIAL 1025 STEEL 2-REQUIRED
DETAIL "C" HALF SIZE MATERIAL 1025 STEEL 2-REQUIRED
DETAIL "D" HALF SIZE MATERIAL 1025 STEEL 2-REQUIRED
DETAIL "E" SCALE HALF SIZE 1-.188 1025 STL 2-REQUIRED
DETAIL "F" HALF SIZE 1-.125 1025 STL 2-REQD
DETAIL "G" HALF SIZE 1.25 1025 STEEL 4-REQUIRED
SHOCK STRUT
HUB CAP
CAST ALUM WHEEL
EDGE WELD
FISH MOUTH WELD
DRILL 1-4"

Building the Chester Racer

by
PAUL W. LINDBERG

Airplane model editor and designer for POPULAR AVIATION.



Here's the snappy little Chester racer completed and ready for flight. It's a peach of a model and well worth building.

THE Chester Racer, by popular request, is the model we present this month. We feel sure, that you will enjoy many interesting hours in the construction of this trim little racer.

In testing this model for flights, our laboratory found it to be an excellent flyer. All details are thoroughly carried out, with a new and improved shock-absorber which operates in much the same manner as the real ship.

All controls are movable with aluminum hinges. False ribs are used in the panels where necessary. All 1935 improvements have been worked into this model, because we want to give you a true flying scale model.

COLOR SCHEME

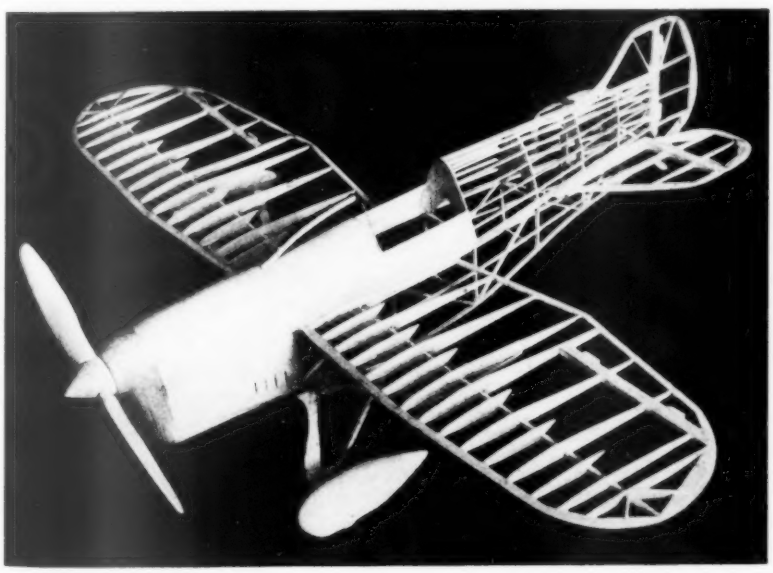
Fuselage — including rudder — dark green trimmed in cream; Wings—cream; Details—black and silver. If you wish a larger model, multiply the measurement by the amount of increase.

CONSTRUCTION OF FUSELAGE

It is necessary to place a sheet of ordinary wax paper over the plan to prevent cement from sticking to the plan. In building the fuselage, construct one side at a time. The longerons, vertical and diagonal braces, etc., are held in place until securely cemented, by inserting straight pins on either side of strips.

After the two fuselage sides are completed, they are pinned to the top view of the plan in such a manner that the top longerons face down and the sides are at right angles with the table. The cross-members are now cemented in place, forming a rectangular fuselage.

Cut formers from $\frac{1}{32}$-in. sheet balsa and cement in their respective positions as shown on plan. Select a soft piece of balsa for nose-block, then carve and sand to shape. Stiff paper is used in covering the fuselage around motor and top of fuselage to cockpit. The position of all stringers is clearly shown on formers. $\frac{1}{16}$x$\frac{1}{4}$-in. balsa reenforcements are cemented to bottom longerons to receive hinge wire, which in turn are cemented to landing gear struts.



The framework is simple and easy to build.

CONSTRUCTION OF WINGS

Cut all ribs from $\frac{1}{32}$-in. balsa. Pin center spar in position an plan. Cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs. The wing panels carry movable ailerons, which are a great help in controlling the flights. Make wing tips from $\frac{1}{16}$-in. balsa.

ELEVATOR AND RUDDER

The elevator and rudder are both of streamline section. The ribs are cut from $\frac{1}{32}$-in. balsa and cemented into position. Balsa $\frac{1}{16}$-in. flat is used for the curved edges and $\frac{1}{8}$-in. square is used for the spars. Round and groove these spars so they will fit within each other. See Plan.

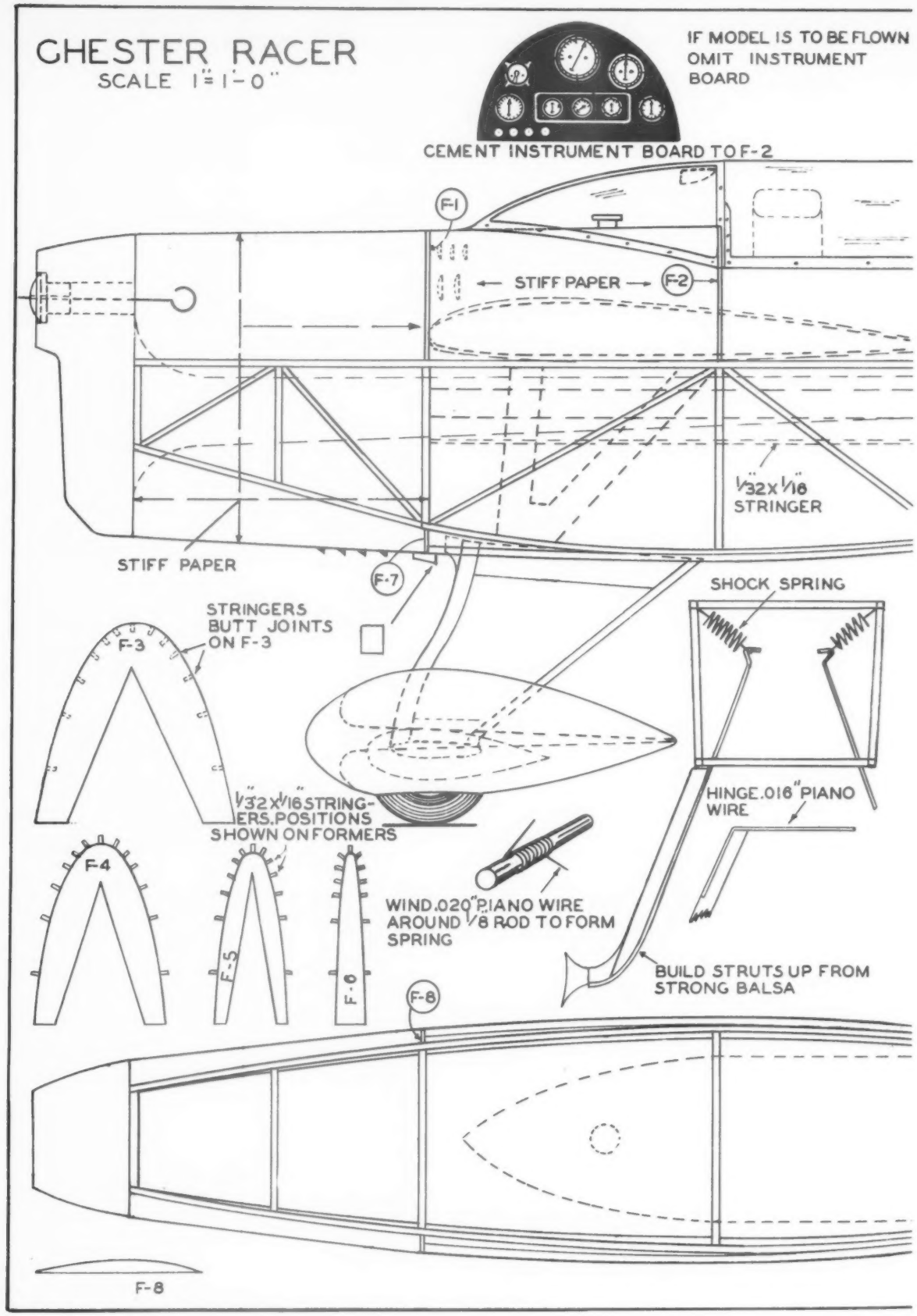
FILLETS

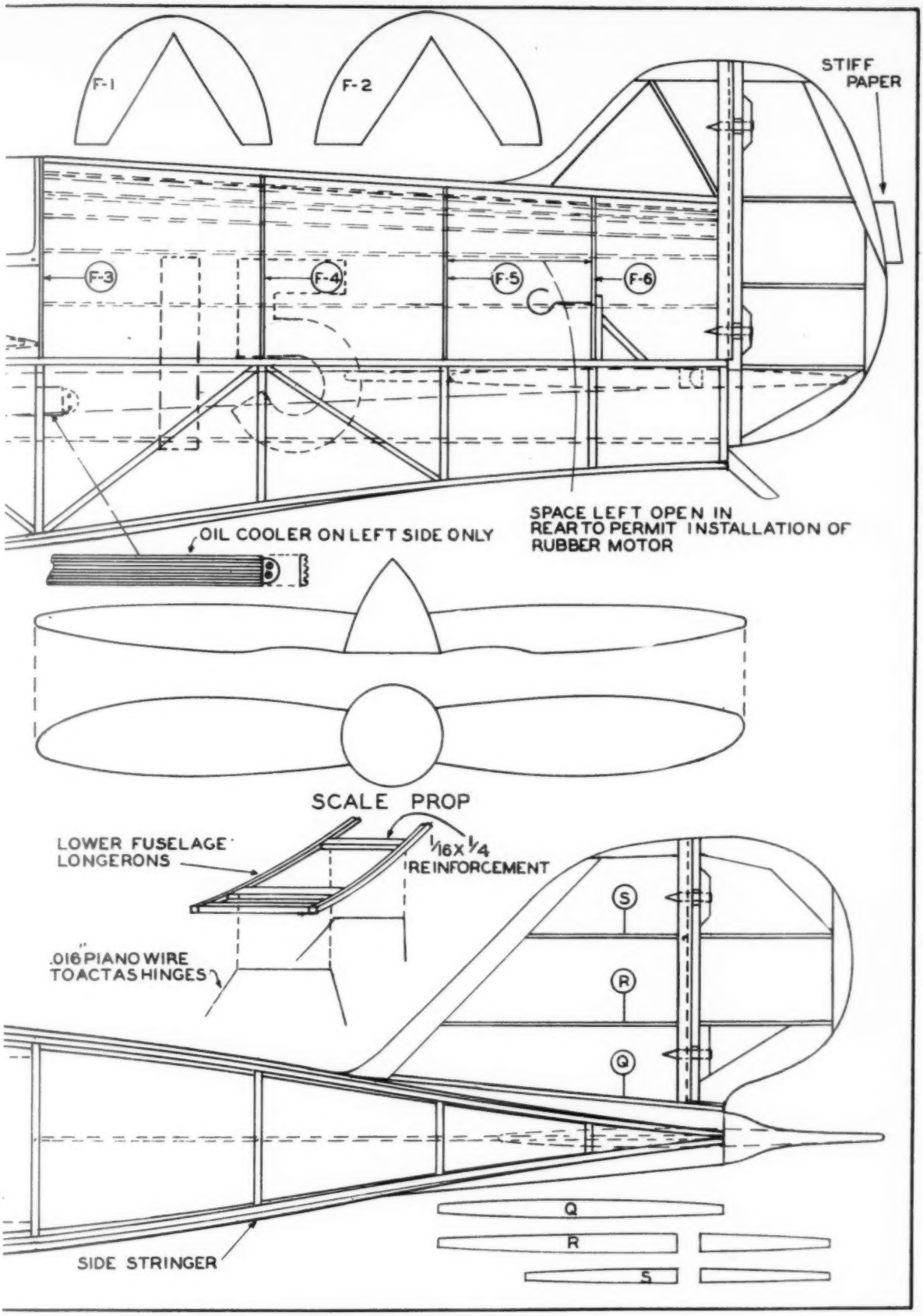
Fillets, connecting the wing panels to the fuselage, are carved and sanded from soft balsa. Great care should be taken when fitting the fillets to the fuselage to receive a perfect fit. Any openings along the edges can be sealed with strips of balsa and cement, then sanded down for a smooth finish.

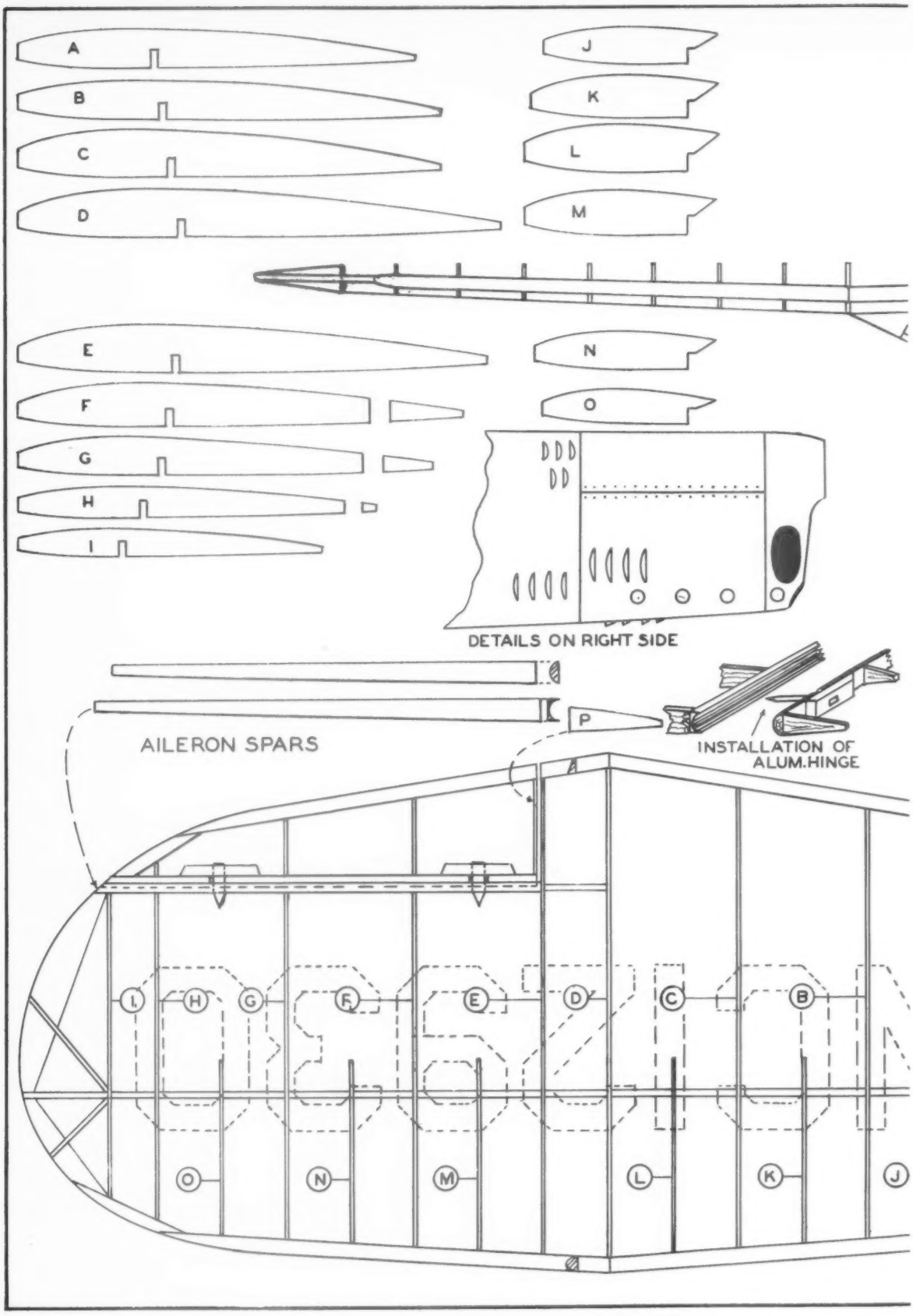
LANDING GEAR

A little patience is required in the construction of the landing gear. Se

(*Concluded on page* 404)


CHESTER RACER
SCALE 1"=1'-0"
IF MODEL IS TO BE FLOWN OMIT INSTRUMENT BOARD
CEMENT INSTRUMENT BOARD TO F-2
F-1
STIFF PAPER
F-2
1/32 x 1/16 STRINGER
STIFF PAPER
F-7
SHOCK SPRING
STRINGERS BUTT JOINTS ON F-3
F-3
1/32 x 1/16 STRINGERS, POSITIONS SHOWN ON FORMERS
HINGE .016" PIANO WIRE
F-4
F-5
F-6
WIND .020" PIANO WIRE AROUND 1/8 ROD TO FORM SPRING
BUILD STRUTS UP FROM STRONG BALSA
F-8
F-8


F-1
F-2
STIFF PAPER
F-3
F-4
F-5
F-6
SPACE LEFT OPEN IN REAR TO PERMIT INSTALLATION OF RUBBER MOTOR
OIL COOLER ON LEFT SIDE ONLY
SCALE PROP
LOWER FUSELAGE LONGERONS
1/16 X 1/4 REINFORCEMENT
.016" PIANO WIRE TO ACT AS HINGES
S
R
Q
SIDE STRINGER
Q
R
S


A
B
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O
DETAILS ON RIGHT SIDE
AILERON SPARS
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INSTALLATION OF
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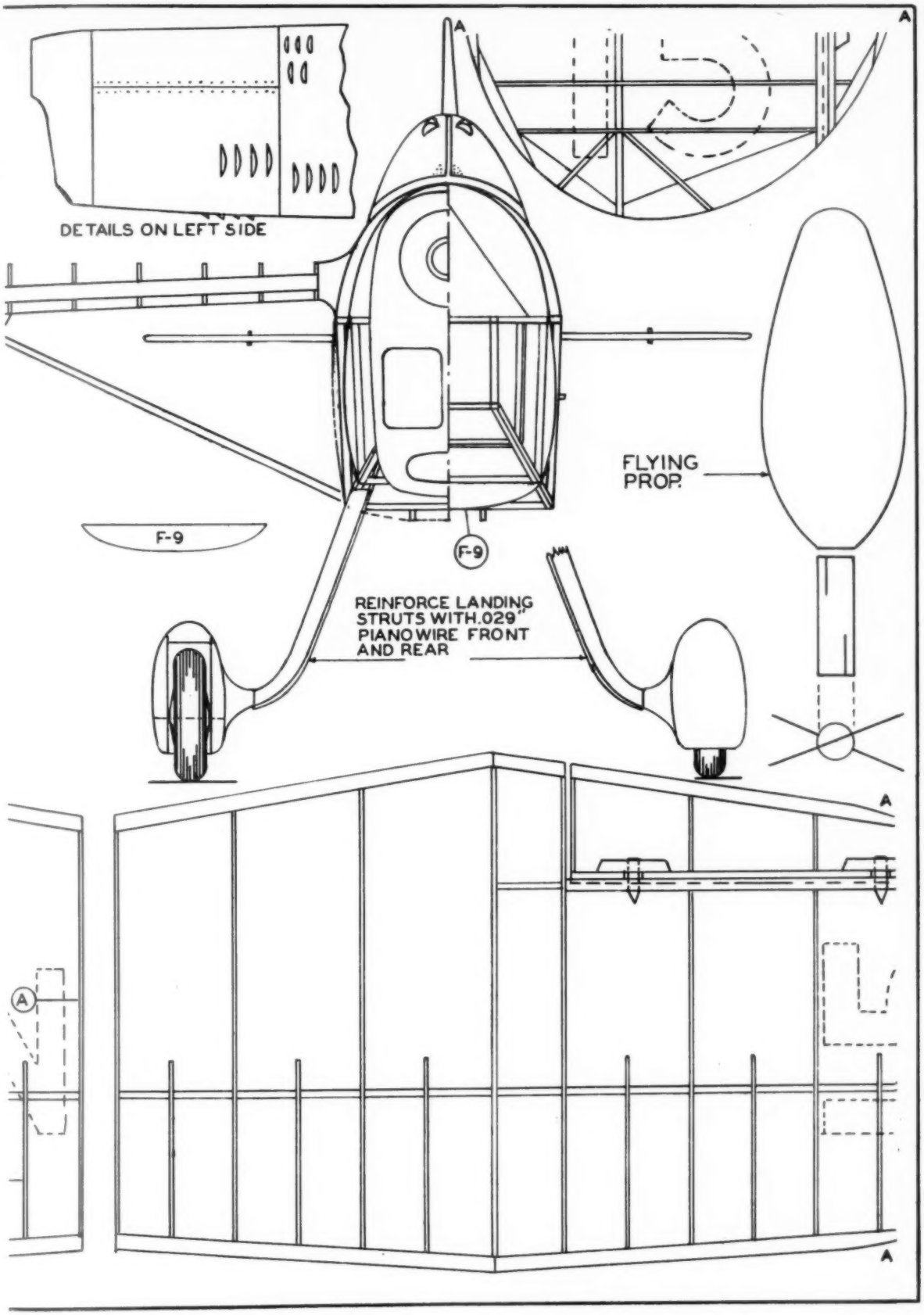

A
A
DETAILS ON LEFT SIDE
FLYING
PROP.
F-9
F-9
REINFORCE LANDING
STRUTS WITH.029"
PIANO WIRE FRONT
AND REAR
A
A
A

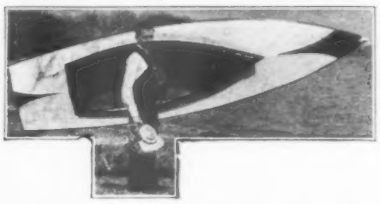
A Model Contest Is Held at Quincy, Ill.

Here are the contestants in the contest sponsored by the Tenk Hardware Company. Photo by courtesy of the Comet Model Airplane & Supply Company.

MANY boys shared honors, recently, in a contest sponsored by the Tenk Hardware Company of Quincy, Illinois. It was a non-flying contest and the boys came through with some nice looking jobs. The winners are:

The Tenk Hardware Company has one of the largest model airplane departments in the Middle West. Responsible for its success are the managers of the Tenk Hardware Company, who have shown more than an ordinary interest in model builders.

Mead Ki-Yak Is Popular



KNOWN as the Model OK-2 Outboard Mead Ki-Yak, this little outboard boat is fast rolling up into public favor. It is the outgrowth of the well known Mead Ki-Yak developed by Mead Gliders, 15 South Market St., Chicago, Ill.

This outboard powered job is 12-feet long with a width of 38-inches, and yet the completed boat without motor weighs only 50-pounds! The Outboard Ki-Yak can be built from the kit with a few simple tools found around the average home and requires no previous experience.

In spite of its light-weight, the Ki-Yak is astonishingly sturdy. The bottom is covered with double canvas, doped into a tough resilient hide and is supported by aluminum ribs. It is practically incapable of shipping water and the smallest of outboard motors propels it at a fast clip.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-59

Briggs Logarithms. Common logarithms based on 10.0.

Briggs Pipe-threads. The standard form of screw thread used in the United States for the connection of steam and water pipe. The thread depth is tapered so that the joints will wedge together air and liquid tight.

Brine. A saline solution of water with a salt such as common sodium chloride or calcium chloride. Used for withstanding low temperatures without freezing.

Brinell Hardness-scale Test. A method of determining the relative hardness of metals. In this test, a hardened steel ball, 1 cm. in diameter, is pressed into the surface of the metal so that an indentation is made by a standard pressure.

Brinell Number. The index of a BRINELL HARDNESS TEST. It is equal to the quotient of the pressure and the area of the indentation surface. For hard metals the pressure is 3,000 kg. For soft metals it is 500 kg.

British Thermal Unit (B.t.u.). The amount or quantity of heat required to raise one pound of water by one degree Fahrenheit (1° F.), near the point of greatest density. One British thermal unit (B.t.u.) is equal to 778 foot-pounds of mechanical energy. This unit is employed for calculating the heating values of fuels, heat required for various operations.

Brittle. A material that is easily cracked or broken without much change in the area of the fractured surface. Glass and some hard steels are examples.

Broach. A tool to produce holes of various shapes, keyways, castellations, etc., by forcing a toothed bar through a previously bored hole by means of a press. Keyways and slots for splined shafts in the hubs of wheels and gears are produced by this process.

Broadcast-band. The range of radio frequencies allotted to commercial radio stations for transmitting music, voice and entertainment to the general public. It includes wavelengths from 200 to 600 meters or frequencies from 150 to 300 kilocycles.

Broadcast-receiver. A radio receiving-set designed for the reception of the BROADCAST-BAND that is, signals having wavelengths ranging from 200 to 600 meters.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-60

Broche (French). Nail.

Brontograph. (1) A diagram showing the movement of thunderstorms. (2) An instrument showing the movement of thunderstorms.

Brontometer. An instrument for showing the movements of thunderstorms.

Bronze. An alloy of copper in which tin is the predominating alloy. A true bronze consists of copper and tin only. Aluminum bronze is the exception.

Bronze (Aluminum). An alloy of copper and aluminum containing up to 11 percent of the latter. It is a very strong hard bronze, the 11 percent grade having an average tensile strength of 95,000 pounds per square inch.

Bronze (Bearing). A soft malleable bronze employed for bearings or supports for rotating shafting.

Bronze (Manganese). As this alloy consists largely of copper and zinc it is really a brass, but it is much stronger than the ordinary brasses. The manganese is used for deoxidizing the molten metal and only slight traces remain in the finished alloy. It resists salt-water and should have a tensile strength of over 70,000 pounds per square inch.

Bronze (Phosphor). This alloy consists of copper with about 4 percent of tin, the molten metal being deoxidized by phosphorous. A small percentage of phosphorous adds to the hardness. It has a tensile strength of about 65,000 pounds per square inch, is tough and resists corrosion and crystallization.

Brouillard (French). Fog.

Brown & Sharpe (Gage). A standard gage system for electrical wires and certain sheet metals and tube walls. An increase in 3 in the gage number, doubles the cross-sectional area. The abbreviation is "B & S."

Bruises. Cover injury with several layers of sterile gauze or cotton and bandage tightly.

B & S. Abbreviation for BROWN & SHARPE.

B.t.u. Abbreviation for BRITISH THERMAL UNIT.

Bubble Inclinometer. An instrument for determining the attitude of an airplane in which a bubble is employed as the horizontal reference just as a bubble is used in a carpenter's spirit-level. Also known as a BANKING INDICATOR when employed for determining the lateral position of the wings in respect to the horizon.

BUILD These Beautiful Super-Detail Guaranteed Flying Planes—All in Exact Scale with Cockpit Operated Controls . . . Designed for you by flying men.

Now You Can Build These New IDEAL Full Detail Ship Models.

Hulls are carved from blocks of soft wood; all detail parts clearly printed on wood to be cut out and attached. Masts, spars, rigging, deck fittings, railings, cast anchors, stands and other details are included. Cut out the parts, cement them together, mount the fittings and decorate the model; it's quick and easy. Full size plan to work from and clear instructions come with each kit.

Each kit contains all parts, material fittings plan and instruction for one model.

CONSTITUTION, 18 inches,
$1.50

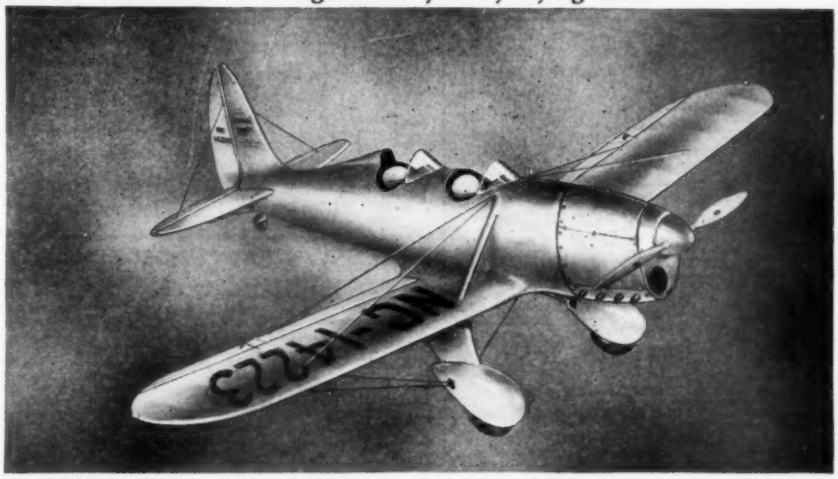
FLYING CLOUD, 18 inches,
$1.50

Build the fastest ship afloat, the NEW Super-Detail model—Italian liner REX.

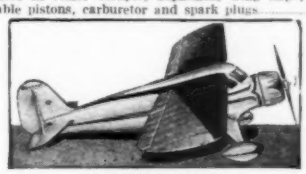
29"—scale 1/32" to the foot

Shaped hull and over 100 metal fittings. 24 cast metal lifeboats; 24 cast stairways, and 2 cast anchors; 4 metal propellers; 6 cast bits; 48 metal davits. The Rex comes in beautiful high luster original colors of black, orange, white, red and green; and the kit also contains turned wood parts, printed wood, cement, wood filler, sandpaper, etc. Full sized plans with complete instructions and 7 photographs illustrating the different stages of construction. All the hard work has been done for you. Kit complete, postpaid..... **$6.00**

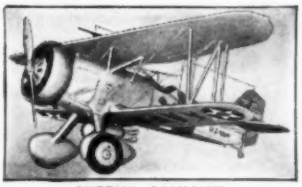
Send 5c for illustrated folder of complete list of boat supplies. Interesting and instructive.



Ryan S T Wingspan 22½", length 16⅛", weight 2½ oz., scale ¾". Complete kit $1.50. Ryan has dual control system which operates in either cockpit; adjustable wing flaps; plans for making an actual working engine—4 cylinders with movable pistons, carburetor and spark plugs..... **$1.50**



STINSON RELIANT
Wingspan 32 5/16", length 21¼", weight 3½ oz., exact ¾" scale.
Adjustable speed arresters built into the wings, movable cabin doors, complete interior with four seats and control column, and all the other Super-Detail features. Colored in bright contrasting yellow and black. Kit complete, postpaid..... **$2.50**



CURTISS GOSHAWK
Wingspan 23⅜", length 16¾", weight 3⅛ oz., exact ¾" scale.
Coated with the new IDEAL high lustre finish, with silver, yellow, red and black coloring. Kit complete, postpaid..... **$2.00**

MARTIN BOMBER
Wingspan 35", length 22½", weight 4⅝ oz. Exact scale.
Retractable landing gear, rotating gun turret, movable machine guns, special streamline cowlings, two types of 3 bladed propellers—one for flying and one for exhibition with removable motor sticks for flying; rudder and elevator balanced surfaces; new type freese ailerons. Kit complete, postpaid..... **$3.50**

BOEING P-26A
Wingspan 21¼", length 18", weight 21½ oz. Exact ¾" scale.
This flying model is an exact replica of the famous fighter—one that is identical in all but size with its noteworthy big brother. Beautifully colored in olive drab and yellow. All Super-Detail parts included. Kit complete, postpaid..... **$1.75**

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Send 5c for the new IDEAL folder showing the latest model IDEAL Planes. It contains valuable information on how you can make real money by building and selling these famous flying models.

DEALERS: You can make more money with IDEAL products. Write for details of more than 100 model airplanes and ship models.

PAULOWNIA WOOD PROPELLERS

As Light as Balsa with Twice the Strength!

NEW LOW PRICES!

Standard Style (Shown at Left)

5	inch	15c each
6	inch	20c each
7	inch	25c each
8	inch	30c each
9	inch	35c each
10	inch	40c each
11	inch	45c each
12	inch	50c each
13	inch	60c each
14	inch	65c each
15	inch	75c each
16	inch	90c each
18	inch	$1.10 each
20	inch	1.30 each

Steel-Type Style (Shown at Right)

5	inch	20c each
6	inch	25c each
7	inch	30c each
8	inch	35c each
9	inch	40c each
10	inch	45c each
11	inch	50c each
12	inch	60c each
13	inch	70c each
14	inch	80c each
15	inch	90c each
16	inch	$1.10 each
18	inch	1.25 each
20	inch	1.50 each

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Please send the items I have checked. I am enclosing $..... (West of Denver 25c extra. All planes postpaid.)
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- ☐ Boeing P-26A $1.75
- ☐ Folder with boat information 5c
- ☐ Stinson Reliant Airliner $2.50
- ☐ Curtiss Goshawk $2.00
- ☐ Folder with aeroplane information 5c
- ☐ Rex $6.00
- ☐ Constitution $1.50
- ☐ Flying Cloud $1.50

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Trophies

(*Continued from page 354*)

necessary expenses in connection with the award have been defrayed.

The first award in 1927 was made to Master Sergeant Harry Chapman for conspicuous bravery in the Airship ROMA disaster, which occurred in February, 1922.

Awards for subsequent years were made as follows:

1928 to Lieut. Uzal G. Ent, Air Corps, for heroism during the National Elimination Balloon Race. He was aide to Lieut. Paul Evert, pilot of the Army balloon, and when it was struck by lightning, Lieut. Evert was killed and the balloon caught fire. Instead of jumping with his parachute, Lieut. Ent remained in the burning balloon, endeavoring to revive his companion, despite the danger of the balloon exploding at any moment.

1929. Lieut. William A. Matheny, Air Corps, for valor during an airplane crash in Nicaragua. He was pilot of a bombing plane being flown to Panama, Lieut. Dwight Canfield being co-pilot. Forced down in the jungles of Nicaragua, the plane caught fire.

Lieut. Canfield, stunned and unable to move from the vicinity of the burning plane, he was rescued by Lieut. Matheny, who rushed into the flames and dragged him away from his perilous position.

1931. Lieut. Robert D. Moor (posthumously). His conduct was that of "Noblesse oblige" of an officer pilot toward an enlisted passenger dependent upon him for security. During a flight, when his plane became disabled, Lieut. Moor, disregarding his own safety, managed to keep it under control long enough for his passenger to jump with his parachute, but too late to save himself.

Private John B. Smith. This was a case of loyalty and devotion toward an officer of his service. Trapped in the burning wreckage of a crashed plane, the helpless pilot was released therefrom only through the valiant efforts of Private Smith, who slid headfirst into the blazing cockpit and unfastened the pilot's shoe which was tightly wedged in the rudder bar.

1932. Private, 1st Class, Arden M. Farley. His act of valor occurred on December 6, 1932, near Pontiac, Mich., when he rescued 2nd Lieut. William H. Dum, Air Reserve, from a burning plane after a forced landing.

1933. To three men for the first time in the history of the Award, viz.: 2nd Lt. Wm. L. Bogen, Air Reserve; Staff Sgt. Doy D. Dodd, 16th Service Squadron, and Sgt. Thomas J. Rogers, 19th Attack Squadron. The act of valor occurred at Fort Clark, Texas, May 4, 1933, when the plane piloted by Lieut. Bogen fell in a group of trees and burst into flames. These three men re-entered the burning airplane and saved the lives of two trapped passengers. END.

NEW

INTRODUCING

SELLEY'S EXCLUSIVE CREATIONS

A REVOLUTIONARY

EXCLUSIVE FEATURES FOUND ONLY IN SELLEY-TEX KITS

MOULDED FUSELAGE—All the beautiful streamlining and graceful curves of the original planes are faithfully reproduced.

MOULDED BULKHEAD—all ready to cement into fuselage.

MOULDED TANK — completely formed and detailed.

SCALE PROPELLER—finished, adjustable and most efficient for flying. Aluminum blades with set screws for adjusting.

MOULDED MOTOR—New true-to-scale, detailed with metal push rods.

MOULDED COWL — Perfectly formed, unbreakable and light in weight.

MOULDED BALANCING RING—The cleverest device ever designed for properly balancing flying models.

CONTROLS—Very simple to install, and positive in action, the most realistic and practical control ever designed.

MOULDED BOMBS & GUNS—Authentic and light, the finishing touch of realism.

MOULDED CELLULOID CABIN—Strong, light and ready to attach.

MOULDED PANTS — Perfectly shaped, complete with fairing.

PLANS—Photographic illustrations show all the detail of construction. These wonderful plans take all the guesswork out of model building.

Each SELLEY-TEX Kit Includes these additional parts:

Rib sheet printed out accurately on white balsa.
A finished scale & flying Adjustable pitch metal prop.
Finished prop shaft & Rear Hook.
Many special turned wood parts.
Scaled wheels, with brass bushings.
Tailwheel and fork fittings.
Finest grade balsa sticks.
Easy to understand plans complete with picture details.
Control horns and wires.
Reed.
Special bamboo paper.
Pure para rubber.
Best quality cement.
Best colored dopes.
Authentic markings.
Colored insignia.

ALL THESE SELLEY-TEX MODELS ARE 24 INCH WINGS

THE NEW RYAN SPORTSTER—An exceptionally realistic miniature, embodying every modern principle of light commercial planes to assure long distance flying.

The SELLEY-TEX moulded parts included in this kit are as follows: Fuselage, balancing ring, nose piece, spinner, head rest, rudder fairing and combination pants and landing gear; these together with special parts and materials as listed complete this outstanding value.

THE NEW RYAN SPORTSTER

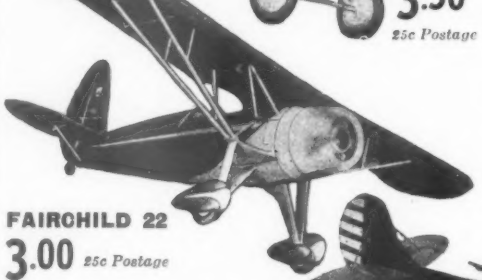
3.00 *25c Postage*

BOEING F4B4

3.50 *25c Postage*

BOEING F4B4—A dynamic reproduction of the popular Navy pursuit plane, developed for stamina and designed for speed.

The SELLEY-TEX moulded parts include fuselage sides, bulkhead, balancing ring, head rest, wheel fairing and tailwheel fairing, special scaled 9-cylinder radial motor detailed with push rods and a drag ring. Also the many special parts and materials as listed come in every SELLEY-TEX kit. WHAT a VALUE!



FAIRCHILD 22

3.00 *25c Postage*

FAIRCHILD 22—A magnificent example of practical model construction, embracing durability of structure and ease of performance.

The SELLEY-TEX moulded parts include fuselage, bulkhead, balancing ring, cowl, pants and pants fairing, special 7-cylinder radial motor to scale with push rods, and exhaust fairing, also all materials and special parts as listed complete this remarkable value.

WACO "D" MILITARY—A wealth of military detail characterizes this formidable prototype of the latest Army innovation, and what a flyer!

The SELLEY-TEX moulded parts comprise the following: Fully detailed fuselage, balancing ring, bulkhead, cowl, cowl bumps, wing mount guns, bombs, pants, pants fairing and a special fully scaled 9-cylinder radial motor with metal push rods.

A special moulded celluloid enclosed cabin windshield is also included to give that added bit of realism, as well as all the special parts and materials as listed complete this unusual value!

WACO "D" MILITARY

4.00 *25c Postage*

SELLEY-TEX CONSTRUCTION SETS

PATENT APPLIED FOR

MARK A NEW ERA IN SIMPLIFIED MODEL BUILDING

IDEA IN FLYING MODEL KITS

VALUE

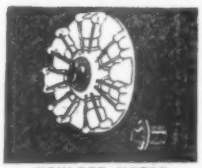
PLEASE READ EVERY WORD OF THIS IMPORTANT MESSAGE!

SELLEY announces an extraordinary achievement without precedent in the history of model building. SELLEY'S LEADERSHIP introduces a revolutionary advance in the creation of SIMPLIFIED MODEL CONSTRUCTION SELLEY has junked the traditions of an industry to give you SELLEY-TEX, the MODERN METHOD of MODEL BUILDING, and whether the industry likes it or not, the old-fashioned methods must go. High pressure selling can no longer justify worthless kits that boys cannot assemble. SELLEY-TEX eliminates 60% of the difficulty found in obsolete balsa stick kits. The construction of SELLEY-TEX flying models is NOW so simple, SELLEY GUARANTEES that the AVERAGE BOY can successfully build and fly them. This cannot truly be said of any other model kits!

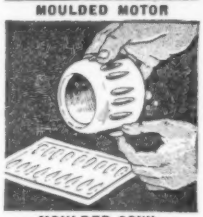
WHAT IS SELLEY-TEX?

SELLEY-TEX is a moulded FABRIC, practically indestructible, lighter and much stronger than balsa wood. It has been developed and manufactured EXCLUSIVELY for SELLEY. No longer need you shape the difficult and complicated parts of a model plane. They come to you perfectly moulded! It is only necessary for you to cement the moulded parts together in order to get a realistic and faithful reproduction of a FUSELAGE, MOTOR, COWL, TANK, BOMBS AND WING GUN MOUNTS. SELLEY-TEX takes all the aggravation and perspiration out of model building! Here is a $10.00 VALUE at a FRACTION of its WORTH. Now SELLEY takes great pride in offering these masterpieces of authentic flying scale models to the boys of America. Buy SELLEY-TEX Kits, the construction sets of TO-DAY and the FUTURE! SELECT and ORDER YOURS NOW!

THE ADVANTAGES OF SELLEY-TEX CONSTRUCTION SHOWN IN PICTURES! SIMPLE AS A B C

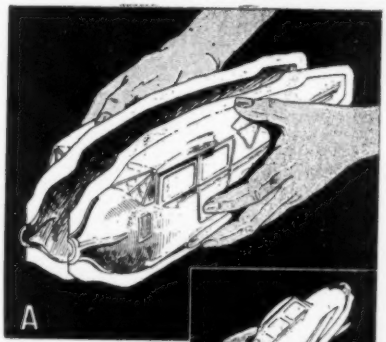


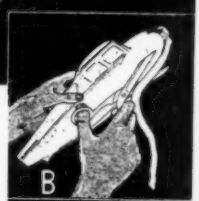
MOULDED MOTOR

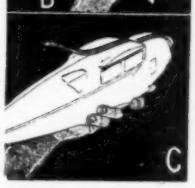


MOULDED COWL

MOULDED BULKHEAD



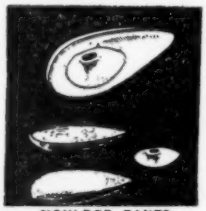




A—Fit together and cement the two moulded parts of the fuselage.

B—Cut away the border of excess fabric.

C—The result is a perfectly shaped fuselage in the form of a hollow shell, very strong and indestructible. The finished SELLEY-TEX plane is lighter than a balsa stick model, thus assuring absolute superior flying performance.



MOULDED PANTS

MOULDED HEAD REST NOSE PIECE and BOMB

PROPELLER

AT LAST! THE MODEL BUILDER'S DREAM REALIZED! Here is the easiest and quickest way to build a model plane. Actually 60% less work! Think of the saving of time and energy! The photographs show you how amazingly simple it now is to build the fuselage, motor with balancing ring, bombs, cowl, tank and guns. SELLEY-TEX kits makes your hobby a PLEASURE instead of a task!

Why pay even 10c for worthless kits you cannot assemble? Pay the difference and get HONEST value. These are the lowest prices for which such incomparable quality can be offered. BUY SELLEY-TEX kits, the SUPER-VALUE!

The beauty, quality and performance of your SELLEY-TEX model will remain long after price is forgotten. Enjoy SELLEY-TEX construction, THE MODERN METHOD of BUILDING!

A FRANK STATEMENT ABOUT OUR BUSINESS

SELLEY wishes to apologize to the model builders of America. Last year an analysis showed us that only 2% of the boys who purchased balsa stick kits can actually complete a finished flying model. This is a general condition in the industry to-day!

That is why SELLEY invested THOUSANDS of DOLLARS in the creation of this sensationally new idea. We now offer you SELLEY-TEX Construction Sets, a PATENT APPLIED FOR method of model building which is the practical answer to your problem. TRY a SELLEY-TEX KIT and CONVINCE YOURSELF!

OUR GUARANTEE FOR YOUR PROTECTION

If the SELLEY-TEX kit you receive is not exactly as represented, or unsatisfactory in any way, RETURN it to us and we will refund your money in full.

Insist on SELLEY-TEX to be sure it's a genuine SELLEY quality kit!

GOSHAWK **4.00** 25c Postage

GOSHAWK—A powerfully attractive flying scale replica of the speedy Navy fighter and accurate to the minutest detail.

The following SELLEY-TEX moulded parts: Fully detailed fuselage, bulkhead, head rest, balancing ring, drag ring, bombs, belly tank, wheel shoes, shoe fairing, tail wheel fairing and a special fully scaled 9-cylinder motor, detailed with push rods, are included and all the fine scale parts and materials as listed complete this very extraordinary value!

IT'S THE SELLEY-TEX MOULDED PARTS THAT MAKE THE VALUE

Selley agrees with the experts, such as Casey Jones, Col. Chamberlain, etc., that there is no substitute for SELLEY-TEX moulded construction. The manufacture of moulded parts takes more time, more money, finer materials and more skillful workmen—but it does make practical construction sets.

WACO "C" CABIN **3.50** 25c Postage

WACO "C" CABIN—A masterpiece of authentic model design, incorporating every scientific feature to insure maximum flying performance.

Fully detailed SELLEY-TEX moulded fuselage, bulkhead, balancing ring, cowl, cowl bumps, pants, pants fairing and a special full-scale 9-cylinder motor, with metal push rods and a special moulded celluloid cabin windshield; and many special scale parts and materials as listed complete this amazing value.

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MFG. COMPANY, INC.
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SELLEY-TEX

ATTENTION DEALERS!

These nationally advertised EXCLUSIVE SELLEY-TEX KITS are a business stimulus. CASH IN on this opportune SALES CREATOR! Write at once for complete information propaganda and discounts.

"Up Gear"

(*Continued from page 350*)

automatic pilot, is made to coincide with the latter as regards indicated heading. For example, if the directional gyro card shows the plane is flying east, then the course card must read the same.

The aileron control must be checked for neutral. This is done when the plane is flying exactly level, by turning a knurled knob which brings two vertical marks into coincidence at the top of the face of the artificial horizon. Finally, the elevator control is set for the position of the elevators at the particular speed at which the plane is then flying and the distribution of load in the airplane at the moment. This is done by turning a third knurled knob, which causes two horizontal lines to coincide at the right of the face of the artificial horizon.

Now the automatic pilot is ready to take control, and by moving one simple hydraulic valve, the pilot turns control of the airplane over to his inanimate, but thoroughly reliable, assistant, which does not care whether the airplane flies thru sunshine, darkness, or dense clouds. Further adjustments may be made, according to the air conditions. There is a separate "sensitivity" control for elevators, rudder and ailerons, respectively. These are also simple hydraulic valves which control the oil pressure to the hydraulic pistons actuating the controls. They may be adjusted until the movement of the controls in correcting for air currents is smoother and more consistent than the pilot himself could produce. Thus, science has relieved the pilot of the mechanical and tiresome function of handling the controls hour after hour during straight and level flight. This leaves him free to attend to navigation and radio contacts. Most important of all, he arrives at his destination without having been subjected to unnecessary physical and mental fatigue.

In the event the pilot deems it desirable to fly thru clouds, he may choose to handle the controls himself rather than turn the airplane over to the automatic pilot. In this case, the artificial horizon, which has been mentioned as an integral part of the automatic pilot, replaces the pilot's visual sense of balance which he normally has by virtue of being able to see the real horizon. The directional gyro tells him exactly the amount in degrees which the airplane may turn from the course. As a further check on what the airplane is doing, the pilot has the airspeed meter, rate of climb indicator, sensitive altimeter, magnetic compass and bank and turn indicator. These instruments are sufficient, without the artificial horizon and directional gyro, to enable a pilot to fly thru clouds with perfect security.

The airplane is contacted every thirty minutes by the ground stations over the radio telephone. This is done on an exact time schedule, so that conversations with several planes in the air at the same time will not conflict. Several minutes before the appointed time, the pilot turns on the radio "Transmit" switch. He then adjusts the ear-phones and takes the microphone from its hook in preparation for reporting promptly. On the designated minute, the ground station from which the plane departed calls that plane—as for example, a plane flying west between Newark and Harrisburg is called by Newark.

The voice of the Newark operator has hardly died out when the pilot hears, "Harrisburg calling 300—go ahead, 300." Now the pilot selects the station which sounded the clearer and proceeds to make his report. For example, "300 to Newark, over Altoona; altitude 8000 feet, scattered clouds at 5000 feet, ceiling and visibility unlimited; temperature 50 degrees." To this Newark replies—"Newark to 300 over Altoona at 8000 feet, OKay." The pilot acknowledges with "OKay, Newark" and the contact is completed. Other radio contacts are made at more frequent intervals when necessary due to weather or other causes. Duplicate sets of earphones and microphone are carried for both pilot and copilot. Each has a jackbox with a switch so that when either one wishes to use the Department of Commerce wave length the other may use the two way radio telephone without interference with each other.

Suppose the plane runs into some thick weather and the pilot chooses to "ride the beam." This means following a Department of Commerce Airway Radio Range Beacon which defines the airways of the country by an invisible path of radio signals, much the same as long stretches of concrete paving mark our major highways. In this case, the airways have the advantage as they run straight with no curves, detours, intersections or traffic signals. As the long wave lengths of these beacons is much different from that of the short wave Company's radio telephone, two separate and distinct radio receiving sets are carried in the plane.

The controls and adjustments are such that the pilot if he desires may keep both turned on at the same time, so that he may hear a Company station call him at the same time he is listening to a Department of Commerce station. In this case the volume control of one receiver is turned down low, to prevent objectionable interference with the other.

In order to pick up the beam, which marks the airway the pilot is then flying, he must adjust the long-wave receiver to the wave length of the station he desires to hear. These wave lengths are promulgated by the Department of Commerce, so that every pilot may know the dial setting on which to pick up any station on or adjacent to the route he flies. Having tuned in on the desired station, the volume control is adjusted so that the signal is of the right intensity.

Let us assume the pilot hears .— (A) .— (A) .— (A) —.. (D). The .— means that the plane is in the A quadrant of the station, and the —.. (D) is the characteristic signal of the station. From his dead reckoning navigation the pilot will normally know from the .— signal that, we will say, he is south of the "on course" signal several miles.

He will change course towards the north about five degrees. As the airplane approaches the "on course" signal, the pilot begins to hear a continuous monotone, or a long dash, ——— under the .— signal. This is known as the "twilight zone" on the "on course" signal. When finally on the "on course," the .— disappears and the long drone of the monotone is broken only by two characteristic signals of equal length, thus ——— —.. —.. ———

Now the pilot must again change his course so that the track of the airplane over the ground will be always within the "on course" beam. As the headings on the beam are shown on the Airway maps in compass, or magnetic readings, it is only necessary for the pilot to fly this heading with due allowance for drift, which is caused by the wind.

Ground radio stations advise pilots "flying a beam" of the whereabouts of any other airplanes flying the same beam. The pilots then talk to each other by radio and agree upon the different levels at which they will fly in order to avoid collision.

The beacon is of the greatest help in approaching airports when the visibility is poor, and, when a plane is being flown on instruments into an airport where a safe ceiling exists. Some 20 to 30 miles from the field, the pilot contacts his Company's Field Manager on the radio, who gives him the ceiling, the visibility, the force and direction of the wind, and the barometric reading of the Kollsman sensitive altimeter.

This last information enables the pilot to set the sensitive altimeter in the plane so that its reading will coincide with the reading of the instrument on the field. In this manner the pilot can tell his exact elevation in relation to the surface of the airport and surrounding obstacles, the height of which he knows.

When the plane nears the station it is desirable to reduce speed to about 100 m.p.h. This is accomplished by lowering the landing gear, throttling the engines, and, after the speed has dropped to 110 m.p.h., changing the propellers to low pitch.

Usually a pilot will approach an airport about 1000 feet above the field surface and safely above all obstacles. As the plane nears the transmitting radio beacon station, the width of the "on course" signal narrows until it is but a band, the width of the average highway. When near the field the pilot

(*Concluded on page 392*)

NEW CURTISS F11C4 NAVY PURSUIT

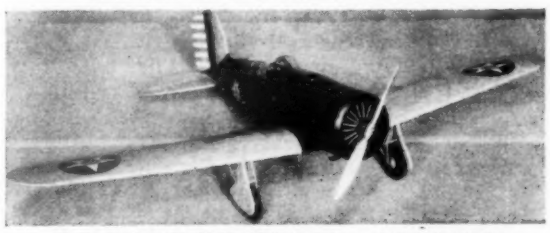
28" Span, Length 20½", Weight 4 oz., Flies 1050 Feet, 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD

A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid, 700 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing. **Construction Set Complete, postpaid** **$4.50**

NEW LOCKHEED P23 ARMY PURSUIT

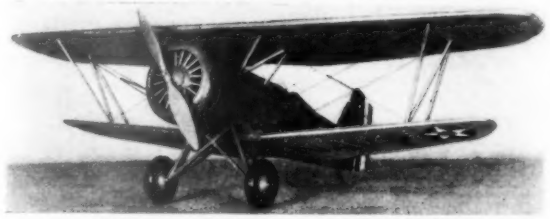
Combination Land and Seaplane Set with Floats



32" Span, Length 22½", Weight 3¼ oz., ¾" Scale Model

One of the most outstanding values in models; it has excellent lifting power, rising from land or water in a few feet. From the latest Army land plane it is convertible into Lindbergh's seaplane by attaching the floats, material for which is in the set. Construction set contains: formers, ribs and pontoon parts printed on balsa, 3⅜" turned cowl front, celluloid wheels, axles, colored insignias, U. S. Army lettering, semi-scale propeller, yellow and drab dope, glue, 33"x44" full scale drawing, etc. **Construction Set Complete, postpaid** **$2.75**

NEW CURTISS SEA HAWK P3A

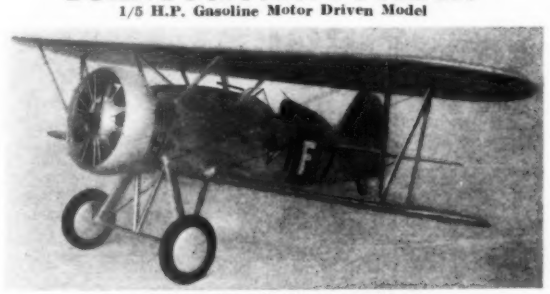


22½" Span, Weight 2½ oz., ¾" Scale Model

An excellent flyer. Will make a fine showing in any contest. Set contains 3" turned balsa motor front, celluloid wheels, colored dope, all parts printed on balsa. **Construction Set Complete, postpaid** **$2.00**

BOEING F4B4 NAVY PURSUIT

1/5 H.P. Gasoline Motor Driven Model



68" Span, Length 44", Color Silver

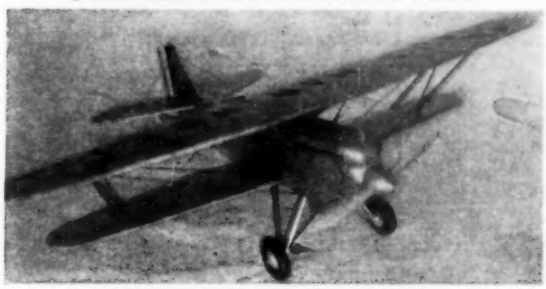
This is not just an ordinary large model, but one specially designed and engineered to stand the strain of the gas motor. An exact scale model 1/5 the size of the real large plane rated as the finest biplane fighter in the U. S. Navy. This is the most realistic and life-like model of this size ever produced. As all the fuselage formers, wing ribs, tips, etc., are all cut out and notched for stringers, spars, etc., even a novice can make a perfect model of it with ease. Set contains 6" turned balsa wheels with bearings, rubber tail wheel, a special spun aluminum 10" speed, cowl ring used on the latest Boeings, silk covering material, silver and red dope, glue, full size scale drawing, axles; all wood cut to size, etc. Weight of model with motor 3½ lbs. **Construction Set Complete, without motor, postpaid** **$25.00**

NEW CURTISS ARMY HAWK P6E

24" Span, Weight 2¼ oz., Color, Drab and Yellow

A new, improved model. Very strong and an excellent flyer. Set includes all parts printed on balsa, hollow metal exhaust pipes, aluminum wheels, 2 oz. yellow dope, 1 oz. drab, 1 oz. paper cement, 2 oz. glue, Army lettering, numerals, bearing button instrument board, tail wheel, colored insignia and all parts to make model as shown. **Set postpaid** **$2.50**

CURTISS SUPER HAWK F6C3



20" Span, Length 13¼", Color, All Silver

A very easy to build set, all parts printed on balsa, turned wood wheels, lettering insignias, colored dope, drawing, etc. **Set, postpaid** **$1.50**

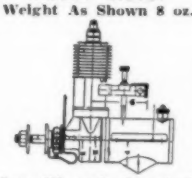
NEW BOEING F4B4 NAVY FIGHTER

22½" Span, Length 14½", Weight 2½ oz., Color, Silver and Yellow

New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished propeller, printed out balsa wood parts, silver dope, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia and ¾" scale drawing. **Construction Set Complete, postpaid** **$2.95**

1/5 H.P. Gasoline Model Motor

Weight As Shown 8 oz.



Long life motor has steel cylinder and piston, ⅞" bore x 1" stroke. Comes complete with gas tank, coil, condenser, batteries. Price ready to run, complete, postpaid **$22.50** only.....

15" or 19" laminated prop. for motor..... **$2.75**

Northrop FTI Navy Fighter

22" Span, Weight 2 oz., Color Silver, ¾" Scale

Exact scale model of the Navy's latest 272 m.p.h. fighter. Set includes all parts printed on balsa, 3" turned cowl front, colored insignia, lettering, colored dope, drawing, etc. **Construction Set, postpaid** **$2.00**

45" Construction Set **$6.50**

NEW ILLUSTRATED CATALOGUE

SEND 3c STAMP AT ONCE

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, N. Y.

XUM

"Up Gear"

(*Continued from page* 390)

keeps in touch with the Field Manager over the radio telephone. The latter will advise him if any other aircraft are in the vicinity, and will keep him informed on up-to-the-minute field conditions.

As the airplane nears the sending station, the beacon signals increase in intensity and the pilot has to decrease the volume control continually so that the signal is just audible. When the plane passes over the radio beacon station, the signal dies away entirely as the plane flies through the cone of silence.

As it emerges on the opposite side of the cone of silence, the signal again comes in with greatly increased volume. This is known as the "surge." Thus the pilot obtains an exact "fix" as it is called in navigational parlance; a position with relation to the nearby airport, which is usually located less than a mile away. Now he will turn towards the airport and gradually lose altitude until the plane is under the clouds and in sight of the ground. At least five minutes before landing 87 octane gasoline is turned on to the engines so that emergency full power may be safely used during the landing in case of emergency.

The task of landing one of these transports is vastly different from that of gliding the average cabin, commercial or sport plane into a landing. First of all there is a lot of "slowing up" to be accomplished. In making a normal approach to a terminal, if the plane has been cruising at or near optimum altitude, the pilot begins his descent 50 to 100 miles away. During this long power glide the speed of the plane averages well over 200 miles per hour. This speed must be decreased to about 56 m.p.h. at the instant of landing.

When a few miles from the field, the pilot contacts the Field Control on the radio telephone and secures an OK to land. The real approach to a landing now begins, and, as at the start of the flight, the atmosphere of the pilot's cockpit is not unlike that of the bridge of an ocean liner being warped alongside her dock.

At the command, "Down Gear," things begin to happen in rapid, ordered succession. The co-pilot removes the safety cap from the handle of the hydraulic landing gear valve and places it in the "down" position. Immediately the valve is opened, the force of gravity starts the landing gear down out of the engine nacelles. If time permits, it is possible to allow gravity alone to bring the gear into position and lock it ready for landing.

To hasten the extension of the landing gear, the co-pilot uses a hand-operated hydraulic pump which forces oil into the extending and retracting cylinders. As each side of the landing gear comes into full-down position, a mechanical spring lock automatically goes into place. The retracting cylinders are then full and a pressure gauge in the cockpit indicates the pressure in the system. When the pressure is adequate, the co-pilot places the hydraulic landing gear valve in neutral position.

A red warning light then goes out and a green light below it lights, indicating that the landing gear system is ready for landing. The co-pilot replaces the safety cap on the valve handle (which prevents the valve from being moved accidentally) and reports to the pilot—"The gear is down and locked."

The increased aerodynamic resistance, or drag, of the landing gear materially slows up the plane and the air speed will drop to about 150 m.p.h. Now the pilot begins to throttle the engines, and after the air speed has been reduced to 110 m.p.h. throws the control which causes the blades of the propellers to take the "low pitch" position. The airplane is now in low gear as compared to an automobile. With the power from the engines greatly reduced, the plane continues to slow down.

As the air speed drops below 100 m.p.h., the pilot orders—"Down Flaps." Again the co-pilot goes into action. In anticipation of this order, he placed the control valve to the hydraulic flap actuating mechanism in the "down" position after extending and locking the landing gear in a down position. All he now has to do in order to lower the wing flaps, or air-brakes as they are sometimes referred to, is to operate the hydraulic pump.

A tell-tale at the bottom of the instrument board in front of the pilot moves, indicating the degrees of depression of the flaps below the chord line of the wing as the flaps go down. At 40 degrees the pump locks and the co-pilot places the flap valve in neutral. He then reports to the pilot, "Flaps are down." Should the air speed exceed 100 m.p.h., a relief valve in the oil line to the flap actuating piston releases and automatically allows the flaps to move up into the wing. This prevents damage to the flaps if the speed should build up.

As the flaps go down, the trim of the plane changes due to the shift in the center of pressure caused by the action of the flaps. This is easily and quickly corrected by a small change in the angle of the elevator Flettners. The air speed drops rapidly after the flaps are fully down. The usual air speed gliding into a field is 60 to 70

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BACHELOR OF SCIENCE DEGREE. Course covers airplane design, propeller design, aerodynamics (including theory of airfoils, stability, performance, etc.) lighter-than-air craft, aircraft engines and all fundamentals. Equipped with a modern wind-tunnel (see illustration) capable of 100 miles per hour air speed; accommodates a 36-inch test model. Non-essentials eliminated. The technical work ordinarily required in 4 years of college given in 2¼ years. Graduates in Mechanical Engineering can complete Aeronautical course in 2 terms (24 weeks).

Study and analysis of entire field of air transportation included. Flying school facilities available at nearby airports. The trained aeronautical engineer is the key man in the aviation industry. Development and progress depend on him. Students who lack high school training may make up required work, without loss of time. Enter June, September, January, March. Courses also given in Civil, Electrical, Mechanical, Chemical and Radio Engineering; Business Administration and Accounting. Living costs and tuition low. Graduates successful. Students from 48 states of the Union and many foreign countries. World famous for technical 2-year courses. *Write for catalog.* 765 College Ave., Angola, Ind.

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Complete kit postpaid $1.00. Catalogue, 3c stamp.

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m.p.h., depending on whether the landing is being made by day or night, the air conditions, and the force of the wind.

At this speed the plane has a steep glide. This feature enables these Douglas transports to land in a short field after approaching over obstacles. Due to the smooth action of the pneudraulic shock absorbing struts in the landing gear, it is almost impossible for a person riding in the cabin to tell when the plane is on the ground.

The combined action of the hydraulic brakes (each wheel has two brake drums, one on each side), and the drag of the air-brakes, causes the plane to deaccelerate rapidly after landing. As soon as the plane has stopped rolling and slowed down to about 10 m.p.h., the pilot orders "Up Flaps." The co-pilot shifts the flap valve, gives several quick strokes of the pump and the flaps are raised flush with the bottom of the wing. He places the valve on neutral and reports,—"The flaps are up."

From this point on, the only operation is to taxi the ship up to the passenger loading gate on the apron which is very adroitly handled by the engine controls.

Thus, a modern airliner is gotten under way, flown and brought into port; and this is only the beginning of a new era in air transportation.

END.

Super-Ace

(*Continued from page* 378)

that it lines up properly in all respects, otherwise your ship will want to go every way but the right way on the ground and taxi-ing will be difficult.

The wheels are of our own design and made of cast aluminum, they use a 20 x 4 in. drop-center tire and the wheels are made up in two halves held together by three bolts, you will find this arrangement has a very good advantage when it comes to taking a tire off, and if you think that you never have to change a tire on a ship, you have a lot to learn. You will note the hub cap for the wheel is located between the two halves and that the axle does not run all the way through the outside half of the wheel, this too has advantages, as dirt and grit cannot get into the wheel. One half of the wheel is put on and the hub cap bolted onto the axle, after which the other half is put on. Of course airwheels may also be used, and if such is to be the case, the axle should be made longer to fit the airwheel used.

On the drawing showing the controls, you will find everything clearly detailed so it will not be necessary to take up a lot of space on the subject.

I have been getting a lot of letters from readers suggesting all sorts of things such as wing flaps, retractable landing gear, wheel pants and about everything else that one could think of and no doubt some of these things would work out okay, but such improvements are up to you fellows, for I would not say that they would work or that they would not. I have designed the ship to be as practical as possible taking everything into consideration and at the same time trying to keep the cost within the reach of the average sportplane fan.

My attention has been called to a mistake in one of the previous instalments regarding the aileron horn, stating the tube size was not shown. ⅜ in. .035 No. 1025 tubing is used for the horn, so make a note to that effect on your drawing showing the aileron. Such corrections as this are only too welcome and I personally, assure you that they are appreciated by yours truly, for after all anyone can make a mistake and when making up a set of drawings it is a very easy matter to slip up on little details.

To those who have read this far without falling asleep, I will say so long until next month, at which time I will help to get you started on some of the final steps of finishing your Super-Ace and offer you the plans for fairing the fuselage, etc. Better get going on your landing gear for it won't be long now!

END.

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1/32x1/16	50 for .05
1/16x1/16	50 for .05
1/16x1/8	26 for .05
1/16x3/16	20 for .05
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3/32x3/32	21 for .05
1/8x1/8	20 for .05
1/8x3/16	14 for .05
1/8x3/8	8 for .05
1/8x1/4	10 for .05
3/16x3/16	10 for .05
3/16x1/4	8 for .05
3/16x3/8	6 for .05
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⅝x1x7	3 for .05
¾x1x8	2 for .05
⅞x1x9	2 for .06
¾x1¼x10	2 for .07
¾x1¼x12	1 for .04
1x1½x12	1 for .06
1x1½x15	1 for .07

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1/64x2	5 for .10
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1/4 x2	3 for .11
1/2 x2	2 for .12

(For 3" Width Double 2" Width Cost)

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1"x1"	1 for .07
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1"x3"	1 for .15
1"x6"	1 for .25
1¼"x1½"	1 for .15
2"x2"	1 for .20
2"x3"	1 for .25
2"x6"	1 for .45
3"x6"	1 for .75

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2 oz.	11c
4 oz.	16c
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1 qt.	90c

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.0003 of an inch thick, 3½" wide, 5 ft. for 5c

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1/16" O.D., per ft.	9c
3/32" O.D., per ft.	7c
1/8" O.D., per ft.	8c
3/16" O.D., per ft.	10c
1/4" O.D., per ft.	10c

WOOD VENEER
(For scale model work)
20"x30", per sheet 20c
20"x15", per sheet 12c

CLEAR DOPE OR BANANA OIL

1 oz.	6c
2 oz.	10c
4 oz.	15c
1 pt.	45c
1 qt.	85c

THINNER SAME PRICE AS CLEAR DOPE

COLORED DOPE
White, yellow, orange, blue, red, green, olive drab, black, silver, gold.

1 oz.	7c
2 oz.	11c
4 oz.	19c
1 pt.	60c
1 qt.	1.00

JAPANESE TISSUE
White, per doz.....20c
Colored, asst., doz..22c

CELLULOID WHEELS

¾" dia., pr.	6c
1" dia., pr.	8c
1⅜" dia., pr.	11c
1⅞" dia., pr.	16c

DUMMY RADIAL ENGINES
(Celluloid, 9 cylinders)

1½" dia.	22c
2" dia.	28c
3" dia.	38c

THRUST BEARINGS
Small or large, 2c ea. or 15c doz.

BALSA BALLOON WHEELS
(Machine Turned)

½" diam., per pr.	3c
¾" diam., per pr.	4c
1" diam., per pr.	5c
1⅜" diam., per pr.	7c
1⅞" diam., per pr.	12c
3" diam., per pr.	20c

15" FLYING SCALE
Model Plans
Curtiss Robin 05
Fokker D-VII Each

ALUMINUM COWLINGS

Size	Drag	Closed	Open
1½"	20c	20c	20c
2"	25c	25c	25c
2½"	30c	30c	30c
3"	35c	35c	35c

SHEET CELLULOID
Transparent

4"x6"	5c
6"x8"	10c

3" DIAM. CELLULOID MOTOR AND DRAG RING COMBINED
First time on the market. Special price....45c

SANDPAPER
Per pkg. 5c

REED
1 1/16" or ⅛" dia. 5 ft. for 2c

DOWELS

1/16" dia. x 12"	9c doz.
⅛" dia. x 18"	2 for 3c
3/16" dia. x 18"	1 for 2c
¼" dia. x 18"	1 for 3c

Accessories That Defy Competition

Be sure to include an order for accessories at these low HEATHE prices . . . each item precision made and exacting in all details.

Bombs

¾" long	4c ea.
1¼" long	9c ea.
3" long	14c ea.

3-bladed Props

1½"	10c ea.
2½"	15c ea.

Pursuit Machine Guns

	ea.
⅜" Pur. Gun	5c
1" Pur. Gun	10c
1⅝" Pur. Gun	15c

Swivel Guns

⅜" long	5c ea.
1" long	10c ea.
1⅝" long	15c ea.

Die-Cast Wing and Tail Lights
3 pr. to a set for
12" model 10c ea.
15" model 20c ea.
24" model 30c ea.

Carved Props with Holes Drilled

5"	9c ea.
7"	12c ea.

2-bladed Props

1½"	9 ea.
2½"	14c ea.

HEATHE Model Airplane Co.
438-606 East 98th Street Brooklyn, N. Y.

MODEL CLUBS
Write for wholesale prices. They are unbeatable!

This Month's Special FREE Offers

FREE OFFER NO. 1—On orders amounting to $1.00 we give free, two 15" Flying Scale plans of Fokker D-7 and Curtiss Robin, printed balsa sheets for these two models, all wing ribs, formers and curved parts printed on balsa. Value 50c.

FREE OFFER NO. 2—On $2.00 orders or more we give 250 feet of ⅛" flat para rubber. Value 85c. Add 10c to cover postage on free gifts.

HOW TO ORDER
No orders under 50c. Add 15c for packing and postage to orders under $1.50. Orders over $1.50 add 10% of order. When ordering 36" lengths add extra 10c. Canada 10c extra. Add 10c to cover postage for gift. Your gift is sent with your order.

We Pay Postage on Kits

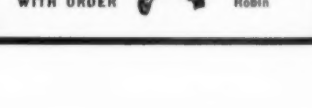
Boeing P-12F

Sale In HEATHE Kits--

Solid Replicas Your choice of Boeing P-12F, Texaco Sky Chief, Spad, Fokker D-VII, Lockheed Vega or S.E.5, furnished with full-size plans and separate instruction sheets and all accessories to complete a perfect replica. **3 for 25c**

15-inch Flyers
2 in 1 Kit, Fokker D-VII

and Curtiss Robin. Astounding value! Contains complete supplies, full size plans, carved props, dope, cement, bent wire parts, etc. Both: Fokker D-VII and Curtiss Robin. **2 for 59c**



FREE CATALOG WITH ORDER

Curtiss Robin

High-Lights

(*Continued from page 366*)

generations. . . . The routes are known as "fly-ways" to scientists and cover four geographical regions, the Atlantic, the Mississippi, the Central and the Pacific and birds using one fly-way never stray into another which is certainly following the "beam."

* * *

MISCELLANEOUS: Bradford Washburn has informed the National Geographic Society that his Yukon expedition piloted by Bob Randall has conquered the St. Elias range making the first airplane flight across the territory photographing a large number of hitherto unknown glaciers and peaks. . . . Pacific Alaska Airways, subsidiary of the Pan American system is planning a seven hour schedule across the entire breadth of Alaska, a journey which now requires thirty-four days. . . . Approval has been given by the War Department for the removal of the new air corps technical school from Rantoul, Ill., to Denver. . . . Other cities recommended as locations for new schools are Dallas and Houston, Tex.; Tampa, Fla.; Oklahoma City and Tulsa, Okla.

* * *

CAPT. AL WILLIAMS made the Thompson trophy award in Cleveland to Col. Roscoe Turner, winner of the 1934 National Air Races 100-mile speed flight and the colonel allows that besides repeating this year he regards Clyde Beatty as a man with NERVE. . . . Say, colonel, did you ever hear of Bob Hickey?

* * *

DURING his second attempt to set a non-stop record between Los Angeles and New York, Wiley Post, flying at altitudes above 30,000 feet, was forced to land at Cleveland when his oxygen began to fail thereby avoiding the recent fate of John Tranum, Hollywood "stunt man" who was "drowned" 27,000 feet above Copenhagen when something went wrong with his oxygen mask. . . . Captain Hawthorne C. Gray of Belleville, Ill., an army aeronaut, died under similar circumstances in November, 1927, after his balloon had reached a height of 40,000 feet.

* * *

AMELIA EARHART has accepted the invitation extended by Eduardo Villasenor, Consul General of Mexico, to make a non-stop good-will flight from New York to Mexico City where she will receive a membership and medal from the Mexico Society of Geography. . . . During the flight, Amelia will make tests of the new Lear radio compass which will be installed in her plane by the Bureau of Air Commerce for which she is now an experimental pilot at $1.00 a year. . . . You can't buy much groceries on $1.00 a year so Mrs. Roosevelt had better keep that White House ice box full.

* * *

AND now folks, let me tell you about the FLYING AUTOMOBILE which has been ordered by the Department of Commerce. . . . Yes sir, it's to be constructed by the Autogyro Company of America, Willow Grove, Pa., and will be quite similar to the usual autogyro, BUT will have FOLDING WINGS so that the plane may be easily kept in a garage and taxied back and forth from the flying fields. . . . HOME JAMES!

* * *

DO you remember Joseph and Benjamin Adamowicz who flew the Atlantic last year en route to Poland?

Well, they returned to their home in Brooklyn, N. Y., to be found guilty in the United States court of conspiracy to operate an unregistered still which had been raided away last September.

* * *

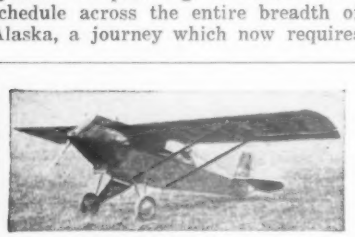
I HAVE heard of the GHOST WALKING, although lately paydays indicate that the ghost is limping a bit, but it seems that recently there was a whole flock of 'em winging over Floyd Bennett Field when a spiritualistic seance was conducted in the darkened cabin of an airliner. . . . According to reports the voices of Wilbur Wright, Sir Conan Doyle, Roald Amundsen, Floyd Bennett and Lincoln Beachey were heard. . . . Oh, Mr. McCauley!

* * *

RECENTLY the Los Angeles, last of the American dirigibles, was damaged ON THE GROUND when it tore loose from the mooring mast to which it has been anchored for a year's study of weather strains and deteriorations. . . . Haven't heard anything lately from the committee investigating the Macon crash. . . . Wonder what's the matter?

It shouldn't take very long to find out that you can't fly PORK BARRELS!

END



36-INCH CORBEN SUPER-ACE

BOYS! The biggest bargain in kits on the market. You'll say so, too, when you see this newest ship. Guaranteed to fly. Complete—nothing else to buy. Best quality materials and plenty of them. Plenty of dope, cement, AA Jap tissue, Grade A balsa, printed rib sheets, printed formers, wire parts formed, scale carved propeller, real scale full size 36" wingspan plans, etc. The kind of ship that wins contests. Kits for making 36" Fokker D-VII or Curtiss Goshawk, Complete, Postpaid..... **$1.00**

1.00 P. P.

Free offer not included with these kits.

18 IN. LENGTHS
1/16x1/16.....100 for 5c
1/16x1/8..... 35 for 5c
1/8x1/8..... 30 for 5c
1/8x1/4..... 10 for 5c
1/4x1/4..... 5 for 5c
1/2x1/2..... 2 for 5c

18 IN. SHEETS
1/32 and 1/16x2 8 for 10c
1/8x2 ..... 6 for 10c
1/4x2 ..... 3 for 9c

18 IN. PLANKS
1x1 1 for 4c|2x2 1 for 18c
1x2 1 for 10c|2x3 1 for 23c

JAPANESE TISSUE
1 doz., all colors, AA 19c

BALSA WHEELS
½" ..... 3c | ¾" 4c
1" ..... 5c | 1½" 7c
2" ..... 10c | 3" 17c

DOWELS
1/16x6.....doz. 5c
⅛x18 .....2 for 5c

WIRE
2 ft. 1c. 25 ft. 10c

INSIGNIA SHEETS
24 and stripe..... 5c

WASHERS
1 doz. ⅛ and ¼..... 1c

PROPELLER BLOCKS
⅛x ⅜x 6.....6 for 5c
⅜x1 x 7.....3 for 5c
¾x1 x 8.....3 for 5c
⅜x1¼x12.....1 for 4c
1 x1½x12.....1 for 7c

MODEL PINS, pkg..... 5c
THINNERS, 1 oz. bot. 5c
REED, 2 ft..... 1c
BUSHINGS, 1 doz..... 3c

Postage paid on all orders in United States for 75c or over. Under 75c, add 10c. Canada and foreign, add 15%. Free catalog. NO STAMPS.

FREE
With every order of $1.00 or over postpaid—
2 oz. bottle CLEAR CEMENT and 100 1/16x1/16x18 BALSA STRIPS

SANDPAPER, pkg..... 5c
PROP. SHAFTS, doz. 8c
NOSE PLUGS, doz.....10c

BIRCH WHEELS
½" .....2c | ¾" 3c
1" .....4c | 1½" 5c
2" 10c

SHEET ALUMINUM
.005 in. thick, 15c sq. ft.
.010 in. thick, 20c sq. ft.

CLEAR DOPE
1 oz.....5c | ½ pt.....30c

COLORED DOPE
1 oz. bot., all colors.... 5c

CLEAR CEMENT
1 oz. bot., 5c; 2 oz. bot. 10c
½ pt. bot..... 35c

MACHINE-CUT PROPS.
5".....5c | 6".....6c
7".....7c | 8".....8c
10".....10c | 12".....12c

BAMBOO
1/16x1/16x12...36 for 5c
1/16x¼x15,ea.1c; doz.10c

THRUST BEARINGS
Small, doz.....10c
Large, doz.....15c

RUBBER
1/16x1/16.....18 ft. 5c
1/8 flat.....15 ft. 5c

SHEET CELLULOID
6x8.....5c | 12½x16...20c

CELLULOID WHEELS
⅝".....pr. 5c | 1⅜".....pr. 10c
1" .....pr. 7c | 1⅞".....pr. 17c

WOOD VEN. PAPER
20x30.....1 for 10c

20 IN. FLYING PLANS 10c—3 for 25c
Texas Sky Chief, Sparrow Hawk, Boeing Trans. 247, Spad Chass., Vought Corsair, Curtiss Swift L. W., Waco Cabin Biplane, Douglas Dolphin, Boeing P-12-F, Fokker D-VII, SE5, Goshawk, Gee Bee.
Dealers, Clubs, Schools: Write for Wholesale Price List.

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SKYWAY AER-O-CRAFT BALSA is "weight controlled" and guaranteed to be the finest balsa obtainable. Only SKYWAY controls and certifies the weight of its balsa.
Dealers—Clubs—Schools—Write for Special List

Balsa, 18 In. Lengths
1/16x1/16....15 for 1c; 85 for..... 5c
1/16x⅛.....6 for 1c; 40 for..... 5c
⅛x⅛.....3 for 1c; 35 for..... 5c
⅛x¼.....2 for 1c; 12 for..... 5c
¼x¼.....1 for 1c; 6 for..... 5c
½x⅛.....1 for 3c; 3 for..... 5c

Balsa Sheets, 18 in.
1/32x2.....5 for 6c; 10 for.....10c
⅛x2.....1 for 2c; 6 for..... 8c
¼x2.....1 for 4c; 3 for..... 8c

Balsa, 18 in. Planks
1x1..... 2 for..... 5c
1x2..... 1 for..... 8c

Propeller Blocks
⅛x¾x5.....1 for 1c; 6 for..... 5c
⅝x1x7.....1 for 2c; 3 for..... 5c
¾x1x8.....1 for 2c; 3 for..... 5c
¾x1¼x12.....1 for 3c; 2 for..... 5c
1x1½x12.....1 for 6c; 2 for.....11c

All Supplies Guaranteed

Wood Veneer Paper
20"x30", 1 for 9c
8 for.....15c

AA Japanese Tissue
1 doz., all colors 16c

Clear Dope
2 oz..... 8c
½ pt.....25c

Insignias
24 for..... 5c

Rubber Motors
1/16 square, 20 ft. for..... 5c

Washers
⅛ & ⅜, doz. 1c

Clear Cement
1 oz..... 5c
2 oz..... 8c

Sheet Celluloid
2x8..... 3c
6x8 4c; 12x16 18c

Celluloid Wheels
¾", pair..... 5c
1", pair..... 6c
1½", pair..... 8c
1⅞", pair.....15c

Thinner, Best
1 oz.....5c

Colored Dope
1 oz. 5c; 2 oz. 8c
All colors.

Sandpaper
Package..... 5c

Reed
3 ft..... 1c

Wooden Wheels
½", pair..... 1c
¾", pair..... 2c
1", pair..... 3c
1½", pair..... 4c
1¾", pair..... 8c

Nose Plugs
2 for..... 1c
12 for..... 5c

Thrust Bearings
1c each; doz. 8c

Bushings
1 doz..... 2c

Bamboo
1/16x15, 20 for 3c
40 for..... 5c
3 for.....20c
1/16 x ¼ x 15, 2 for..... 1c

Wire
3 ft. 1c; 20 ft. 10c

Aluminum Leaf
2 sheets for.... 1c

PLANS
9" Plans, each 5c
3 for.....12c
15", each..... 8c
3 for.....16c
20", each..... 8c
3 for.....20c
Waco Biplane, Texaco Sky Chief, Spad Chasseur, Swift Curtiss, Sparrow Hawk, Vought Corsair, Gee Bee, Ott Hydro model.

Send 3c stamp for "Helpful Hints for Model Builders" and catalog for other bargains. This booklet FREE with all orders.
ORDERS 50c or under 15c postage. Postage prepaid on orders over 50c. West of Mississippi add 10c extra. Canada add 10c extra. CASH OR MONEY ORDER—NO STAMPS. NO C. O. D's.

SKYWAY MODEL AIRCRAFT SUPPLY CO.
7 Fuller Ave., Floral Park, N. Y.

$1.50 THOMPSON SUB MACHINE GUN $1.50
Complete kit with machined barrel, magazine, all necessary hardware and full size working plans.....$1.50
Colt calibre .45 automatic pistol..... 1.00
Colt calibre .25 automatic pistol..... .50
Colt calibre .22 automatic pistol..... 1.00
Savage calibre .32 auto. pistol with mach. barrel..... .75
Luger auto. pistol cal. 9 M/M W/4" mach. barrel.... 1.75
Colt single action Frontier revolver with machined cylinder, rod ejector and 4¾" barrel..... 1.45
These beautiful kits are complete in every detail and made of the best materials. They are to be made for exhibition purposes and you will be more than proud to display them. Postpaid, U.S.A. No stamps. Checks 15c.
GUN MODEL CO., 2908 N. Nordica Ave., Chicago, Ill.

Noises

(*Continued from page 373*)

the causes, engineers may be able to quiet the total noise.

This milestone in engineering progress was made possible by the development in the research laboratories of the Westinghouse Electric and Manufacturing Company of a portable noise analyzer, that equals the sensitivity of the best known type of laboratory analyzer, and yet is so rugged that it can be carried about and used almost anywhere.

Not to be confused with ordinary noise meters which measure only the intensity or loudness of a noise, the new portable analyzer diagnoses a noise, separating it into the different elements which compose it, and measuring the pitch and intensity of each component.

The noise analyzer which was developed by W. O. Osbon, Westinghouse research engineer, consists of three small leather covered cases. One case contains a noise meter, the second, the noise analyzer, and the third, a microphone and batteries.

The noise analyzer is not nearly as well known as the noise meter which measures only the total noise or loudness. The noise meter gives noise ratings of boiler factories, offices, gunfire, rustling leaves, and the like and informs the world how many times noisier Time Square in New York City is than the corner of State and Madison Street, "the world's busiest corner," in Chicago's loop.

Although not as spectacular and therefore not as well known to the public, the noise analyzer accomplishes a much more important work and its findings will have an important influence on the design of machinery and mechanical equipment in the future.

Already the noise analyzer has been of material assistance in reducing the noise of electric motors. When a motor is exposed to the supersensitive ear of the analyzer, engineers are able to find out how much of the total noise is caused by unbalance of the rotor, how much by the commutator bars, what part by slots in the rotor and what part by gear noises. It also enables them to trace the causes of the noise so that they can eliminate these causes at their source.

Housewives may be interested in knowing that the analyzer has already played an important part in giving them quiet electric refrigerators, washers, ironers, vacuum cleaners, and other motor driven appliances. In all these cases, the analyzer has been invaluable in eliminating or minimizing noise elements caused by the motor parts, fan assembly, gear drive and similar parts.

It is a well established fact that sound plays a very important part in the health and happiness of human beings; that sounds made up of discords—noise—have a harmful influence upon health, happiness, and efficiency.

Recent investigations by a group of psychologists reveal the fact that the pitch, complexity, and variation of complexity of a noise are much more important factors than mere loudness or intensity in determining the harmful effect of noise upon production in industrial and office tasks.

This scientific recognition of the importance of noise characteristics emphasizes the need for and establishes the place of the noise analyzer in man's unceasing fight to reduce noise.

The analyzer is similar in appearance to a radio set. On its panel are switches, dials and meters; inside are four vacuum tubes, condensers, transformers and similar apparatus. All this equipment is compactly built into a leather covered case. To understand this operation a knowledge of the principles of sound and vibration are necessary.

Sound is the result of an object vibrating within the audible range. The vibrating object causes alternate expansions and contractions of the medium surrounding the object, and these pressure changes are transmitted in waves by the medium to all points in the vicinity of the sound source. Thus, a sound wave exerts a definite pressure on any object, such as a human eardrum, located in the sound field.

As a standard, scientists have agreed upon a barely audible sound of 1,000 vibrations per second. Such a sound presses upon each square centimeter of an average eardrum with a force of 1/5000 of a dyne, the dyne being the scientist's unit of force. Expressed in ordinary units this sound pressure is equivalent to about three billionths of a pound per square inch.

There is a curious relationship between the frequency (or the number of vibrations per second) of sound, the intensity of its source, its loudness and the pressure on the eardrum. Osbon explains that if two sounds are of equal loudness, the sound having the lower frequency will have a greater intensity at its source and will exert the greater pressure on the eardrum.

For instance if a piano note "C," two octaves below middle "C," and the "C" two octaves above middle "C," 64 and 1,024 vibrations per second respectively, are struck so easily that both of them are barely audible, the lower "C" will emit 90,000 times as much energy and exert 300 times as much pressure on the eardrum as the higher "C."

As sound increases in loudness, the pressure exerted upon the eardrum increases tremendously. For example, a sound of 1,000 vibrations per second, when barely audible or, as the scientist would say, at the threshold of hearing, exerts upon the eardrum a force of only 1/5000 dynes per square centimeter (1/6 square inch, approximately) but this sound, when increased in loudness to the threshold of pain, exerts a force of 3,000 dynes per square centimeter.

Respect for the human ear grows with the realization that it functions through such an extreme range of sound intensity and pressure,—in this case the loud sound exerts 15,000,000 times as much pressure on the eardrum as the quiet sound does, while the sound energy increases in the staggering ratio of 225 million million (225,000,000,000,000) times!

Researcher Osbon points out that the noise analyzer not only measures sound pressures approaching these tremendous extremes with the greatest accuracy but it does so at the same time it is singling out one element of a possible dozen elements that go to make up a noise. The secret of the analyzer's extreme sensitivity and selectivity is in the electrical circuit employed—the superheterodyne circuit, the most selective yet designed.

END.

THRILLS, MONEY in RACING!

And there's fun in building your own racer. Kuns tells how in new book containing pictures, working drawings, full description of racers. Midgets, dirt track cars, 125-135 m.p.h. stock car conversions, speedway racers, fully described. $1 postpaid, $1.12 c.o.d., 3c tax in Ohio only. Money back if not satisfied.
Ray F. Kuns, Dept. 32, Madisonville, Cincinnati, Ohio

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A Systematic course of lessons for home or school use in question and answer form for those wishing to qualify as aircraft engine mechanics. The book is also of value to pilots or students wishing a general and diversified knowledge of aviation engines and their accessories. This book is written in simple language and considers in detail all leading types of aviation engines, describing principles on which their operation is based. Prepared specially for the shop and field mechanic and student pilot.

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STREET OR R.F.D. .....
CITY ..... STATE .....

Airports

(*Continued from page 370*)

States, bulletin boards on which are posted weather information, offices of the various airlines and the Department of Commerce weather bureau.

In this last, a battery of special teletype machines are constantly receiving from all over the country weather reports and automatically transcribe them into airway weather maps. Every four hours, a new weather map is posted.

A car draws up to the entrance of the station and disgorges a load of passengers for the next plane. Porters grab the luggage and take it to the ticket counter, where it is weighed and checked through to the passenger's destination. The passengers have their tickets checked, the public address system announces that the plane is ready for loading. Another load is on its way.

In some instances the airports are owned by the airline operating through the city. In the case of large cities, however, the airport is usually owned by the city and the operators and airlines using it pay rent. In such a manner does the airport earn part of its operating expenses. A gas tax is sometimes imposed to help defray expenses. A typical list of charges for use of the field by private planes is below:

Landing fee, including storage of plane on ground for one day, or fraction thereof	$ 1.00
Daily storage fees, including landing privileges:	
Hangar space	2.00
Ground space	1.00
Monthly storage fees, including landing privileges:	
Hangar space	40.00
Ground space	20.00
Passenger toll, for each passenger carried for hire, except planes in transit	.50
Mechanician services:	
For straight time (8 to 4:30) per hour	1.50
For overtime, per hour	2.00

All planes operating on or from the field must hold to the rules of taxiing, as to route and speed, take off, blocking of wheels, running of motors, position in respect to other aircraft, testing, time permitted on runways, etc.

Safeguards for the visiting public must be provided, in the way of areas to which they must be restricted so not to endanger their lives or interfere with operations on the field. On most large airports today fences keep visitors on a dry concrete apron where they may watch flying operations, loading of planes, arrivals and departures, with safety and comfort.

One would like to see airports all over the country made more of as show places, and an effort made to get people to come out and inspect them and watch operations. The Pan American Airways terminal at Miami has a restaurant which is famed for its excellent food, its beauty and the opportunity afforded passengers to dine and at the same time be able to see out over Biscayne Bay and watch the arrivals and departures of the big Clipper Ships. The more the public is encouraged to familiarize themselves with air transportation and see how things are done at first hand, the more readily will they accept the airplane as a means of transportation. Much has been done in this way in Europe and the field is wide open for exploitation in the United States.

In Holland, for example, which is one of the pioneer nations in commercial aviation, specially conducted tours through the airports and shops are offered to the public. The purpose of these little journeys is not only to familiarize and enthuse the travelling public with air-travel but to impress upon the public the great care that is taken to insure safety and reliability.

The K. L. M. in Holland is to be complimented on this educational movement which should be adopted by our American airlines. The more that the public sees and contacts in aviation, the greater his enthusiasm for air-travel. It is possible to attract many people by this method.

How about a little campaign by the readers of this article? If everyone who reads POPULAR AVIATION would make a practice of taking someone out to the airport each month who had not been there before and who was not familiar with the operations at airports, it would do no end of good in the way of educating the skeptical.

END.

Crashing Thru

Right From France

The Morane-Saulnier, France's newest fighter will be featured on the July cover. Be the first to build this trim, speedy flyer from the accurate plans, which will be shown exclusively in P. A. A full set of ice-clear photographs just received direct from the manufacturer, Paris, France.

Another big feature you have been waiting for! Fifteen additional WORLD'S AIR INSIGNIA. The complete plane markings of the world powers' airplanes, with exact illustrations of the foreign planes and details on the air force.

You can't afford to miss these features which will be shown exclusively in the JULY P. A.

Don't miss the JULY ISSUE

Hull Tests

(*Continued from page* 352)

cuits for the control of the electrical braking of the carriage. Opening one of these circuits sets into operation automatically controlled regenerative braking, opening the other, dynamic braking. The operator can select either of two points along the tank at which the circuit controlling the regenerative braking will be opened and braking produced. He can do so by means of a switch at the control desk. In case the incoming line voltage fails the braking automatically changes to dynamic.

Either the operator at the control desk or the persons on the towing carriage can apply the electrical braking. There is also hand-operated brake for facilitating final stops. If the other braking systems should not work, the carriage is stopped by the emergency brakes at the end of the tank. This has only been necessary in one instance.

The whole propelling system is controlled at a control desk at the south end of the tank. Braking, acceleration and the constant speed are all determined here. The persons on the car can stop the car at any time, but have no ability to set the speed. From the time and the distance run, the speed at which the carriage has been propelled is determined. An electrical impulse is sent to the dynamometer every second by a clock on the carriage. An indicator in the dynamometer corresponding to every five feet of travel gives the distance.

A motor-generator set in the shop section provides the direct current for operating the carriage.

The towing pull is attached to the model at a place corresponding to the center of gravity on a regular craft, and about this point the model can swing freely, when tests are made free to trim, or it can be held at any desired trim, so that the moment that is required can be measured. A pointer moving with the model and swinging over a graduated scale indicates the trim.

The deflection of a spring through which the constraining force is applied shows the amount of the force and the moment necessary to constrain the trim. Through the point of suspension of the model is applied a vertical lift to simulate the lift derived from the wings of the full-size craft.

At the front end of the towing gate are two vertical suspension links which bear a part of the weight of the gate and any reaction from the trimming moments. This avoids any vertical forces on the weighing device of the dynamometer. One horizontal link joins the beam to the weighing device which is a stiff spring in the form of one flat plate of steel. The measurement of pull exerted by the model is taken from the deflection of the spring.

The upper end of the spring is presumed to have no deflection, and is firmly joined to a large tube supported in the middle girder of the carriage. The deflection of the lower end of the spring is magnified by an arm attached to it, and extending up into the tube. The upper end of this arm bears a stylus, the point of which pushes against a vertical plate mounted on a horizontal staff that also carries a horizontal mirror. The plate on the mirror staff is held against the stylus by a minute hairspring.

From the top of the tube a beam of light is projected against the mirror and reflects back against a slit in the top plate of the tube. When a sheet of sensitized paper is moved at constant speed across the slit the reflected spot of light traces a curve that is visible when developed. A series of parallel straight lines are ruled on the record by light rays from six fixed mirrors. These are placed to provide reference lines.

There is another special arrangement so the operator may be informed as to the magnitude of the pull exerted by the model during the run. This is a second beam of light projected against the measuring mirror at such an angle that as it returns to the top of the tube it may be intercepted by a horizontal mirror set to reflect the beam against a translucent screen.

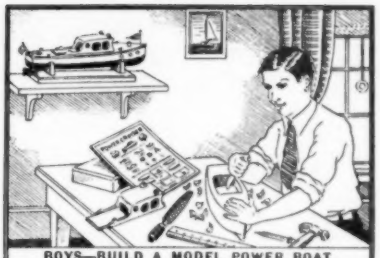
The speed of the car is determined from the records of time and space covered. A succession of dots made by flashes of a lamp lighted every second by the timing clock indicate the time. Breaks in a line traced on the sensitive paper by the light reflected from a galvanometer mirror inside the tube give the distance. The deflection of this galvanometer is made by the amplified impulse coming from the photoelectric tube which is lighted every 5 feet as the car moves along the track.

The record thus obtained includes a curve showing the pull exerted by the model, a series of dots which show the time in seconds, and a broken line, the deflections from which indicate 5-foot intervals of progress. Speed may be computed from the time required to cover a given distance, or the distance covered in a given time.

There are two methods of testing models of hulls or floats. The earlier or specific method was developed at first to get information regarding an aircraft for which most of the essential data are known. A second or general method does not require this information, and at the same time gives much more complete information than the earlier method. Both methods can be modified and may be partially combined.

The general or "complete" method is especially useful if no data are at hand as to the complete airplane with which the float is to be used. In this method the model is towed at a number of fixed weights on the water with fixed trims and at various constant speeds,

(*Concluded on next page*)



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PATENT *YOUR IDEA*

Test Tank

(*Continued from page 397*)

and the resistance, trimming moment, and rise are determined for each of these. This method requires more runs, but gives information which can be applied to more widely varying conditions of load, get-away, position of gravity, etc.

In comparing the take-off of a landplane and a seaplane it becomes apparent how important it is that there be a reduction in the resistance to motion on the water of a flying-boat hull or seaplane float.

The total resistance of a landplane before it leaves the ground consists of the sum of the aerodynamic resistance and the resistances due to friction and rolling along the ground. The sum of the last two is a maximum at the moment of beginning to move and becomes steadily less until it becomes zero at take-off. Compared to the resistance at take-off the initial value of the total resistance is not very large and at no time before take-off does it exceed that at take-off.

In a seaplane, however, the total resistance before the craft leaves the water is the sum of the aerodynamic resistance and the hydrodynamic resistance. The course of the seaplane is the same as for the landplane, but the hydrodynamic resistance shows great difference. From zero at the start it rises rapidly until at "hump" speed it may be double the total resistance at get-away. It decreases then, sharply at first and then more slowly, until it becomes zero at get-away.

The total resistance at hump speed often comes surprisingly close to equaling the thrust at that speed. Should there be any decrease in thrust or increase in resistance at this speed the margin of thrust available for acceleration might easily disappear and the craft would not be able to reach a speed above the hump speed and could not leave the water.

That hump of resistance menacing the propeller thrust is obviously the point to be attacked if we desire to improve the performance of seaplanes. For each reduction in its height and extent there will be a decrease in the time and distance run to get-away and the margin for contingencies between the thrust and resistance will correspondingly increase.

In the landplane little can be done to reduce the already low rolling and frictional resistance while on the ground and it is mainly the aerodynamic qualities that determine the time and length of take-off run. In the seaplane the hydrodynamic resistance is preponderant throughout almost the whole run on the water and reductions in the time and length of run to get-away must come practically entirely from reductions in that resistance.

Small changes in the form or dimensions of the hull of a seaplane may have great effect on the hydrodynamic resistance. It is difficult to perceive such effects on small models. When larger models can be used, as in the N. A. C. A. tank, the changes themselves may be of a substantial nature and naturally the effects will be relatively easier to interpret.

The tank, therefore, insures that the hull form will be within the limits required for proper performance, saving much time on full scale experimental work.

Parade

(*Continued from page 361*)

During the last parade in which I took part, I found time for a few hurried glances at the ground as the parade passed over the edge of San Diego, California. Several cars on a main boulevard had stopped and the occupants were quickly filing out to gain an unobstructed view.

Such evidence of interest by the public in San Diego indicates something out of the ordinary is taking place overhead, for in this air conscious city a small formation is no longer unusual.

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Airy Chat

(*Continued from page 346*)

Wallie is a transport pilot himself, as you probably know, and this helps out a whole lot in filming an air picture.

* * *

SOMEONE wrote in to ask whether there were any girls or women making airplane models. I don't know of any, but if any of you readers do know of one, please notify me.

* * *

AIRLINES, above all other systems of transportation, should endeavor to maintain a more accurate schedule. As it stands now, it is nothing out of the ordinary for an airliner to be anywhere from 15 minutes to 30 minutes late, not only on arrival but at departure as well. In the mind of the traveler, the major advantage of air transportation is speed, and when this belief is dispelled by chronic tardiness, air travel will suffer.

* * *

WE have had many letters, recently, from our English readers, telling of the rude rough way in which the English government handles the amateur, particularly the amateur airplane constructor. But, when we get down to the bottom of the snarl, the operations of the English government are very similar to our own. There is the same old string of blue prints, stress analysis sheets, approved materials and all the rest of it. And, the funny part of the whole program in England, as well as in the United States, is the fact that the approved and certified ships are a long way from being exempt from crashes and structural failures.

* * *

WE receive, literally, hundreds of letters asking us how young men without money can get into aviation. The writers of these letters believe that there must be some sort of an apprentice system by which an enthusiast can earn his way into the profession, trade or what have you.

Unfortunately, for these earnest young men, the chances are about 1,000 to 1, against any such good fortune. Occasionally, via the friendship route, a young man will contact a pilot with the necessary qualifications who is willing to exchange instruction for labor or other compensation—but this is not often. The only certain method is to get money by working in some other line and then spend this money with a good aviation school.

* * *

AND as a further bit of information, we advise the intending pilot to visit a physician sanctioned by the Bureau of Air Commerce and submit to the necessary physical examination befor spending much time or money on the project. Be sure that you have the necessary physical qualifications before you go to work in earnest.

WE are going to have a feature next month that will be of the greatest importance and interest to many of our readers. This will be an up-to-date list of aircraft manufacturers. We have so many requests from our readers for these addresses that we feel that this new feature will be of unusual value to them. This list will include every manufacturer together with address, who produced aircraft last year.

* * *

THE leading article in this issue, we believe, will prove to be one of the most instructive that we have yet published on the subject of airplane operation. "Up-Gear" and "Down-Gear" describes every operation in the flying of a modern transport plane and is written by a transport pilot who has had much experience on the Pacific Coast. It is authentic in every detail and is well worthy the attenion of beginners in the science of aviation.

* * *

STRANGELY, the depression has not had the same influence upon commercial aviation as it has had on other major industries. The commercial airlines have prospered in spite of the hard times during the past seven years and have built up a tremendous business in times when other systems of transportation were hard pressed.

J. B. R.

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⅛x3/16	50c
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10¾" Howard Tko., 25c
11¾" Fokk. "Triplane," 45c
14¼" Boe P-26, 65c
13" Turner's Wedell-Williams, 50c

Gasoline

(*Continued from page* 364)

ficulties placed in its path of development, it does seem a shame that one more such obstacle should be brought up for it to overcome. These are the things which always detract attention of those in the industry away from what would be constructive activities and cause them to be dissipated in worry over possibilities which never should be in the picture.

It has been claimed by some authorities that from a technical standpoint, an alcohol-gasoline blend has much to commend it, even when compared to a refinery gasoline not containing alcohol. These statements all have been criticized and to a great extent refuted by the impressive showings made by technical figures of high standing. However, to point out some of these claims, they include those that the blend has fine burning properties and results in the production of comparatively little carbon monoxide. Extensive claims also are being put forth to the effect that it is a superior product from the standpoint of detonation.

This is a vital point to aviation, since the increasing trend toward greater horsepower rating of power-plants and higher compression ratios and pressures, continues to bring out a greater demand for high anti-knock value motor fuel. This particular point is decidedly in dispute but there are so many eminent authorities on the negative side of the detonation aspect of the dispute that it would seem to leave much doubt still to be settled.

If this were all, though, it might not be quite so bad. There remain many other questions. One is the matter of price. It is generally conceded that one of the objectives of the whole plan is to maintain corn and other cereal grain products in this country at a high price level for the farmer's benefit. This would mean that the raw material being used for the production of the alcohol to be used in the motor fuel would be kept at a high price.

Even at the low prices ruling for corn, wheat and rye a few years ago, it was figured that any substantial percentage blending of alcohol would involve an increase in the ultimate consumer's price. With corn selling at higher prices, also wheat, today, such differential would be still higher.

Then there is another important physical operating consideration. Everyone knows that the motor fuel to be used successfully in aviation must be clean, pure and non-clogging. Let us look for a moment at an important quality of alcohol—namely, its solvent property. The effect of blending has been well stated by an authority as follows:

"When blended with gasoline, it has a solvent, cleansing and loosening action on the metal parts of the tank, fuel lines and carburetor, particularly when the float is of cork shellaced type. The blend is also markedly corrosive to galvanized parts. The sediment carried down by the alcohol fuel tends to plug up the feed lines, filters and jets." —Something nice to have in the tank of your plane, eh? Perhaps it was due to this and not to the stratification that your plane stalled in the air, as mentioned at the beginning of this article. And again, in the words of a noted authority of a foreign university (blends have been used extensively under certain restricted circumstances in foreign countries)—

"When using alcohol fuels, considerable trouble was experienced with the choking of filters and jets. The alcohol seemed to have a scouring action on the pipes, picking up any scale and dirt and carrying these forward to the carburetor. After running for some time on alcohol this feature became less troublesome, but at best there was always more trouble and stoppage than with petrol."

There are other troubles encountered in using alcohol as a fuel, it is pointed out by authorities. For example—

"With alcohol's high flash point and ignition temperature, the heat units required to vaporize an equivalent quantity of alcohol are about 250 percent more than those for gasoline. The ignition temperature for alcohol is about 975 degrees F., while that for gasoline is 750; the flash points are likewise favorable to gasoline. This tends toward a sluggish and harsh running motor until it is thoroughly heated up. Further difficulties have arisen due to a tendency of the motor to run hot with alcohol fuels."

Results obtained at the University of South Africa are interesting: "Harshness of running is so marked when starting up that the engine will not carry anything like its full load for some time. An examination of the engine always showed that the moving parts were much drier and free from lubricant than when petrol was used. Alcohol has a very detrimental effect upon the oil film on the walls of the cylinders." Some lubricating oils tend to emulsify in the crank case when using alcohol fuel in the motor.

These and other considerations would seem certainly to call for caution from any industry requiring motor fuel as its life-blood as aviation does. It should be more especially and more keenly interested in it than even the automobile and the petroleum industries since both the latter are not so insistent as is aviation on extremely high quality motor fuel first, last and always. Alcohol in the engine of an automobile might cause trouble with the resultant inconvenience, annoyance and loss of time, perhaps money, to the driver. But alcohol in the engine of an airplane, it can be seen, might cause such trouble as would have ghastly consequences, beside which that in automobiles would be puny in comparison.

END.

Airplanes Wanted

If you wish to purchase any sort of airplane, new, used or a crack-up, insert your notice in this column. This service is FREE, and we solicit your notice. The management of POPULAR AVIATION, however, reserves the right to reject any or all notices that are not acceptable under its policy.

MOTORCYCLE ENGINE PLANES

HEATH factory job wanted. This must be a licensed plane for which I will trade a $100 share in a well producing syndicate and one undivided acre in 160—4 wells.—F. A. WETZELL, Shawnee, Okla. P.O. Box 465.

LIGHTPLANE WANTED. Prefer a Heath or Aeronca, but any plane between 36 and 80 horsepower in good condition will be considered. Will pay from $150 to $250 for a suitable ship. —CLIFFORD DICK, Route 1, Box 81, Aberdeen, Idaho.

OX, KINNER, WARNER OR LE BLOND ENGINED PLANES

WANTED, an OX engined or air-cooled two or 3-place open plane in need of overhaul and recovering. It must be flying now and must be cheap for cash. Preferably, this plane should be located within 500 miles of Rochester, N. Y. No crack-ups or junk considered.—J.C.W.

WANTED. A one, two or 3-place plane, preferably a licensed plane or one that is eligible for a license. If in good shape and a bargain will also consider an unlicensed or identified plane. Must be cheap. I can furnish some cash but would like to have easy terms for the balance. I have a 170 bass accordion which I will trade in on plane in addition to cash.—A. SOLSTEN, Fosston, Minn.

WANTED. 3-place uncracked licensed plane in good to fair condition, preferably an OX Bird. No junk considered. The price should not exceed $400. Send in full description, terms, etc.—KENNETH HOULIHAN, C. C. C. Camp, Moorhead, Iowa.

WANTED. I am in the market for one of the following planes: Velie Monocoupe, LeBland Arrowsport or OX Bird. The ship need not be licensed but must be eligible for a license. Either a two or 3-place ship will be considered. This will be a cash transaction. so price your ship on this basis right from the beginning of your correspondence.—GENE SABATHIER, 1018 N. Miro St., New Orleans, La.

WANTED. Will buy a plane without the engine, that is built for the use of a Kinner K-5 engine. The price must be reasonable. If possible, please send photo of the plane as it now stands. No crack-ups nor junk considered. —EDWARD D. TRACHT, Galion, Ohio, Route 3.

WANTED. I would like to locate a good Warner-Cessna in any condition, so long as it is complete. Will also consider other planes of the same class if such planes are of approved types and makes. I also wish to get a Warner engine or the parts for this engine, and also a metal propeller.—JACK SMOLIGAN, 5133 S. 24th St., Omaha, Nebr.

WANTED. A licensed plane or a plane eligible for license. Prefer on OX5 Waco-10 plane or any similar type of ship powered up to 125 horsepower. Lightplanes of approved type and in good condition will also be considered. Cash or trade.—J. MAGISH, care Aero Club, RD-2, Box 410, West Albany, N. Y.

WANTED. An OX5, or Challenger engined plane, or an approved 2-place plane of other type. Must be licensed or eligible for a license. —EDWARD J. LAMBERT, 821 E. Willard St., Philadelhia, Pa.

WANTED. Velie M-5 licensed monoplane or other licensed air-cooled ship of like horsepower. Must be reasonably priced. I have an identified Anzani-Pietenpol as part payment.—JOHN R. DOWALO, 144 Thompson Ave., Donora, Pa.

WANTED, an old OX5 ship needing overhaul and minor repairs. Must be cheap. Would like to have terms.—EDWARD M. DAVIS, Spring Ave., Halethorpe, Md.

AERONCAS—CUBS—CORBENS—NB'S

WANTED. I am looking for a C2 or a C3 Aeronca or a similar lightplane. Will consider a minor crack-up or ship needing recovering if priced right.—DALE BRETZ, 1295 Inglis Ave., Columbus, Ohio.

WANTED. Light two or 3-place licensed air-cooled ship, preferably an NB-8 or Barling NB-3. Will consider any reliable plane, however, such as an OX5 Bird or Waco-10, but no other OX job. This shipment must be reasonable in price, cash or terms, responsible party. HAL BLACKSTONE, R. F. D. 2, Ames, Iowa.

WANTED. 2-place lightplane or training plane, Aeronca or Taylor Cub preferred. Must be in good condition and a licensed plane will be given preference. State price in first letter.—FRANK STUMPF, care of Paul Huebert, 8109 S. Throop St., Chicago, Ill.

WANTED. Licensable lightplane, one or 2-place. Will consider used or cracked Taylor Cub, Aeronca, Aeromarine Klemm, etc. Will consider a ship without engine and I also want a good used Salmson engine needing overhaul. I have a $300 glider, fittings and parts, diving helmet, ice-boat and $100 cash.—WALTER SCHAEFER. 308 Locust St., Clearfield, Pa.

WANTED. A C2 Aeronca in good condition. I will spend $250 for this ship, but it must have a government license or must be eligible for this license. The ship must have Vee type landing gear.—JESSE G. MILLER, Route 2, Lockport, N. Y.

WANTED. A lightplane, preferably a Corben Junior. Will purchase or trade. I have RCA and GE radios, new, any model, also motorcycles and bicycles. Must be a bargain for cash. price not exceeding $150.—STERLING HOSTETLER, Topeka, Ind.

WANTED. A licensable ship, a J5 Open job preferred, but will consider anything. The condition of the ship is not of importance if the price is low. I have an excellent custom-built high-grade, medium size automobile to trade with additional cash if the condition of the ships warrants it.—A. K. M., 10 Willard Place. Montclair, N. J.

CRACK-UPS WANTED

WANTED. A cracked lightplane, 2-seater, such as the Aeronca C3, Rearwin Jr., or Eaglet with repairs and replacements within limits. I will trade a real snappy Heath "V" Parasol, streamlined and finished with a racy 3-color combination. Test flown only. No major crack-ups will be considered.—C. J. SPENCER, Kingston, Mich.

WANTED. A used or cracked plane, any make or type considered. Preferably under $100. Must be under $200.—DANA W. HECKERT, Permelee, So. Dak.

NOT CLASSIFIED

WANTED. Any type of lightplane in the 2-place class. Must be an air-cooled job, licensed. Would prefer a Monocoupe or other cabin ship of that class. The ship must be delivered for which I will pay the expenses. I have up to $500 to invest on a ship of this type but would go higher if satisfied of a better job.—HENRY P. BLUMLEIN, Croton Falls, N. Y.

WANTED. A 2-place open or closed lightplane. Must be licensed. Engine 40 to 65 horsepower. Preferably air-cooled. Can pay about $350.—AL. STEWART, Box 144, Grace, Idaho.

WANTED single or 2-seater lightplane. Must be in good flying condition. No crack-ups nor junk wanted. I will accept any type but an old Heath Model V. I have $125, but can raise a few more dollars if necessary. Send a photograph of the plane.—MICHAEL MARINO. 577 Seybert St., Hazleton, Pa.

WANTED. An airplane for about $100. Any make or type of ship in any condition in this price range will be considered.—ARNOLD W. SHOEMAKER, Gen. Del., Burlington, N. C.

WANTED. A glider at a reasonable figure. preferably a Mead or Leonard secondary or a light primary glider.—DAVID V. MILLER, St. Charles Road, Glen Ellyn, Ill.

WANTED. A lightplane in good condition. preferably with a license or identification number. Price must be reasonable. — JOSEPH STENGLEIN, Seneca Falls, N. Y.

WANTED. A light 2-seater used plane. One economical to operate. I have very little capital on hand but could make a small down-payment with the balance on a $20 per week basis.—K. VAN TASSEL, 558 Park St., Montclair, N. J.

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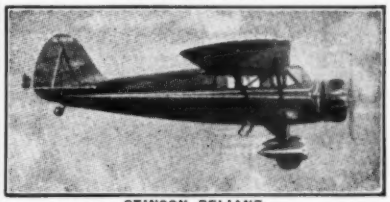

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'31 CHRYSLER Deluxe 8 sport roadster, A-1 condition, six wire wheels, etc. Will trade for two place Aeronica or Davis Monoplane. Must be A-1.—J. Dickinson, 419 Linden Ave., Wilmette, Ill.

AIRPLANES

WILL TRADE diamond value $450 for licensed airplane.—J. P. Comerford, 37 Congress St., Buffalo, N. Y.

ALCO MONOPLANE, factory made wings, new covering, needs doping, dope furnished. Complete except motor. Will take motorcycle, boat and motor or cash.—William H. Reed, R. No. 1, Streator, Ill.

AIRPLANE-RADIO-TRANSMITTER and Receiver. Cost $1,000. Want good airplane, licensed. Also swap bicycle motor, electric drill, grinder for light airplane motor, welding outfit or ?—Winzer, 4237 S. Olive, Los Angeles, Calif.

FOR SALE OR TRADE: Low wing sport plane, instruments, less motor. Identified. Photo 10c. $100.00 cash, approved chute or 16 mm. movie projector.—E. B. Gorham, 3439 Drummond Pl., Chicago, Ill.

REARWIN JUNIOR—Latest Szekely—300 hrs. 25 hrs. since top overhaul. Newly licensed. Guaranteed A-1 condition. A real bargain, $550.00. Light car accepted as trade.—Marvin R. Hensley, 408 W. Second St., Dayton, Ohio.

TRADE complete Mead primary glider, less wing and covering for good light outboard motor.—J. Heraptha, 357 S. Salina St., Syracuse, N. Y.

EAGLEROCK—Trade for car or $190; Robin, trade for car. OX-Bird for aircooled. List of almost 300 others, 20c.—C. J. Dry, Box 456, Athens, Ohio.

LICENSED SECONDARY GLIDER—Pruefling type; German Construction; Wolf Hirth, Builder. For Sale or trade.—Intercourse Glider Club, Intercourse, Pa.

1932 HEATH with Scintilla, V landing gear, new props. Flyaway $200 or late coach or sedan. Wanted: Henderson conversion parts.—Tice, 13718 Eaglesmere Ave., Cleveland, Ohio.

HAVE COMPLETE chemistry kit like new worth $75.00. Will trade for any aeroplane in fair condition or motorcycle, or what have you. —Joe Morino, 5032 S. Lotus Ave., Chicago, Ill.

ONE INCH micrometer, golf clubs, radiator, to trade for Heath parts or cash.—Leroy Miller, 1873—13 Ave., Moline, Ill.

WANTED welded fuselage and wings for 2 place Corbin-Pietenpol or Skyscout, or similar ship. Also want wheels, tires and tubes; also converted Model A Ford motor. Pay cash or trade plywood, spruce, Anzani 50 H.P. motor and other Aircraft material. Send your list, and we'll send ours.—John Kamm, 524—12th St., Oshkosh, Wis.

ENGINES

WANTED—Used 40 H.P. aircooled motor. 4 in line or twin opposed. Prefer 4 in line. State condition and terms. Trade, cash or both. What do you want?—Raymond Bellmore, P. O. Box 663, Clinton, Mich.

TRADE OR SELL, Hisso motor, complete with mount, oil and water radiator, oil tank. Want, 8.50. 10 semi airwheels or what have you?—Albert Grazioso, 647 Valley Road, Clifton, N. J.

MOTORCYCLES

HARLEY DAVIDSON "45" 1929. Will trade for "Great Lakes" parts, cash or what have you, or will pay cash for "Great Lakes" parts. —Clarence A. Bryce, 39 Wells St., Croswell, Mich.

MISCELLANEOUS

SWAP—26 Epps Biplane ribs built of spruce. Want Robert Bosh FU-4 magneto, altimeter, 24x4 S.S. wheels or?—Leo Ray, Box 1075, Clarendon, Texas.

WANTED: Aviation magazines.—M. Butcher, Rye, N. Y.

TRADE. 40 issues Popular Aviation, 56 issues Model Airplane News, 32 issues Popular Mechanic, 17 Modern Mechanic, 27 Popular Science, 5 issues Aviation, piece Shenandoah gasbag 10"x18". Want fishing rods, reels, lures, or what have you?—Andre Hooper, 624 Ninth St., Huntington, W. Va.

OUTBOARD RACING BOAT. Electroplating Outfit; Race Car parts. Want lightplane engine, parts.—John Kritzski, 435 May, Pottstown, Penn.

WANTED—Winter Flying suit, size 40, or Panel type compass. Will trade portable phonograph.—F. M. Short, 1708—8th St., Anacortes, Wash.

WANT MOTORCYCLE. Have $108 Conn trombone.—Emsie Thompson, Jr., 32 N. Water St., Gallatin, Tenn.

IN EXCHANGE for aviation course which costs $1,100, requires 8 months for completion, young man will work as pilot or mechanic for 2 years. —Lee Spratt, Jr., P. O. Box 522, Logan, W. Va.

99 AIRPLANE MAGAZINES, trade for Smith and Wesson or Colts pistol or?—Winston Golitz, Pleasant Hill, Mo.

TRADE—Outdoor Life magazines for Aero Digest or Popular Aviation.—Walter Poeschel, Hermann, Mo. (R. 3, Box 113).

Aero-Sportswoman

(*Continued from page* 358)

Club, was appropriately gowned in a flight-tex costume called "Happy Landing." Senora Hermelinia Brione of Ecuador, the only licensed woman pilot in South America, wore a model known as "Chiquita Pilota," and Clara Studer wore an ensemble of flight-tex called "Airwoman."

Other women pilots who appeared as manikins in the revue included Isabel Page, Genevieve Smith, Jessamine Goddard, Annette Gipson, Peggy Remey and Alma Harwood.

* * *

ANOTHER achievement of the New York chapter of the 99s, which will be of great interest to other sections, is the fact that they have actually acquired *a ship of their own!* So that a number of their members who have lost their licenses, because of the high commercial prices and other such minor obstacles such as the Department of Commerce's fifty-hour ruling, can regain them at a minimum cost.

We are sorry that we can't give you the details of how they secured the ship, but they are to be congratulated on this very important step in helping pilots to get back into the air!

* * *

WE think that a story about an airplane getting stuck in the mud is almost on a par with the one about a man biting a dog. But when it comes from the land of sunshine and roses, surely it should be classed as "most unusual," as the natives alibi their weather.

Anyway we got a good laugh out of Ruth Wakeman's tale of seeing California from the air! Said she, "Yesterday when I took friend husband for a little joy hop, spotting what looked like a delightful airport, I cut the gun and sat down . . . and down . . . and down she went until the mud was halfway up on the pants! Full throttle and plenty of cussing did no good, so Bill in his best Sunday suit climbed out and added a few more 'horse-power' to the Warner. With full tanks of gas, there was no getting off with both of us in, so when the Fairchild began to show signs of moving, I stalled her off and left my poor husband stranded in the mud."

Ruth gave us another chuckle in the same letter when she told how dumfounded she was one morning recently, to have the clerk in a grocery store greet her by name. She said, "I was so astonished at his knowing my name, but when he said, 'You are the woman flyer from Chicago, aren't you?' I was simply agog!

It developed that he had seen the picture of our group of 99s at the January meeting at the Municipal Airport, in POPULAR AVIATION and had recognized me from the picture." (A ha! J.B.R., please take note, here is more proof that the male devotees of PA do read our modest column!)

* * *

THERE are three other items in my collection this month that are worth mentioning. First a picture of Amy Johnson that appeared recently, shows the famous woman flyer in a bathing suit, *knitting*, on the vacation sands of Maderia. This may not seem very aeronautical, but if it convinces some of the dyed-in-the-wool groundlings, that daring women pilots can be feminine enough to enjoy such a popular pastime as knitting, perhaps it will be of more value than another ocean flight.

The other two items might be cited as an interesting example of the difference in the way "air-consciousness" is being fostered in these United States and in communistic Russia.

The director of the travel bureau of Northwestern University has arranged for a series of flights for students, "to make them air-conscious." Over a hundred students took advantage of the first of these trips. They were given a *half-hour* flight in Curtiss Condors over Chicago and the suburbs.

In Russia, the government has planned a series of training flights for young people in their twenties. The first of the series was a *seven-hour* flight from Moscow to Leningrad, with the 22-year old woman pilot, Marie Aikhenvald, at the helm of the government owned dirigible Smalney V-2. Interesting? We could not help contrasting the two stories, both of which appeared in the same weeks news items.

END.

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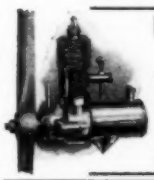

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Chester Model

(*Continued from page* 381)

lect a strong grade of balsa for the landing gear. The curved section of landing gear that joins the fillet, is best made by cementing balsa on an angle, carving and sanding it to shape, after it has become completely dry. Reinforce landing-gear struts with piano wire.

COVERING THE MODEL

Apply tissue to the various framework members, using a light grade of model-airplane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator, and such upon a flat surface to keep from warping.

Next, apply a coat of clear dope to all surfaces. Now apply colored dopes. Note, do not try to cover frame when it is completely assembled. Wings, elevator, etc., are cemented to fuselage after they have been completely covered with tissue.

ASSEMBLY

The wings, elevator, rudder and landing gear, etc., can now be cemented in their correct positions. Four exhaust pipes are cemented to lower right hand side of motor cowling. Two types of propellers are shown on the plan. The flying propeller, which has fiber blades and has less r.p.m. in order that the model can fly a greater distance. Make sure propeller is properly adjusted and balanced in order to obtain best results.

Four to six strands of ⅛ flat rubber are sufficient to fly the model. Properly balance model before attempting to fly ship under power.

END.

Propellers

(*Continued from page* 377)

Note how the R.P.M. varies in the air on different airplanes using the same motor, while on the ground the R.P.M. is the same. In comparing air speeds of two airplanes using the same diameter and pitch propeller, you will find that there is also a very noticeable difference.

This is largely due to the influence of the nose of the ship and its effect upon the slip-stream.

This article touches only the highlights of the propeller problems with which most amateurs are confronted. However, it is the hope of the writer that it will give the Home Builder some idea of how a propeller can and will improve the performance when it is properly designed for the airplane on which it is to be used.

END.

Horses

(*Continued from page* 360)

the Barker Flying Service and School, located at the Sacramento Municipal Airport, joined us as pilot.

It was after Jerry took over the flying on that day, we found ourselves in the valley with hardly enough gas left to get back to Hawthorne. This put us on the spot for there was no place to land nearer than Hawthorne, and we had to climb 4,500 feet to get over the mountains.

Jerry headed straight for Hawthorne but we couldn't seem to gain altitude and the mountains began to loom up like a giant wall. We knew that if we had to circle around to get over them we would surely run out of gas. We were trying to decide just what to do when all of a sudden we found ourselves about four hundred feet above the highest crest. Thank God we had hit one of those up drafts. We landed at Hawthorne airport and as we started to taxi to where we kept the plane the engine died.

There was one band of fuzztails we could not get off their mountain top. No matter what action we took them would only circle the acre or so of rocky mountain top on which they were grazing. To get these horses off this platque, became quite a sporting problem with us.

Finally, we took up a case of empty beer bottles and flew directly to the mountain where the bangtails held out. We flew down to within seven or eight feet of their backs. I grabbed a beer bottle and let fly. The bottle with a crash broke into hundreds of pieces. The horses became more frightened as I continued to bombard the ground at their sides with the bottles. Finally they scattered in every direction from the mountain top.

The next time, we found a bunch we couldn't budge and, being out of bottles, we used tin cans with rocks in them. This worked just as well.

We found out just how stubborn a wild fuzzy can be when we spotted three on a small platque and tried for several minutes to run them off but without success. By this time we were becoming peeved and Ernie was working the plane nearer the ground every time we circled. One of these horses would stand up on his hind legs every time we neared and strike at the plane, squealing all the while.

Finally, in one last attempt, Ernie flew the plane still lower. I held my breath for the horse reared directly in our path. So close did we come that in trying to get out of the way the horse fell over backward into a gully and the others followed him. We had won our battle for we had them on the way to the corral.

The horse is probably one of the most picturesque and still one of the hardest animals to catch. You have about a 60 percent. chance of catching him if you have the proper equipment. A few of the horses we caught were fit to be broken for saddle horses while the others, because of their stunted growth caused by hard winters, were good for nothing more than making dog food and chicken feed. They bring about ten dollars when sold for this purpose.

If you want to experience a sport with plenty of thrills, take an airplane and wrangle wild horses, but be sure you have the proper kind of a plane. It must have plenty of power and be made for altitude flying, yet it need not have much speed.

The Pitcairn Mail Wing, that we used, was a good machine for the work, excepting that it was a little too fast, having a cruising speed of 110 miles an hour. Just as important, though, if you want to carry on the work for commercial purposes, is to have a corral constructed as previously outlined. A ground crew of seven or eight men is also necessary to take care of the horses after they are guided to the corral.

There are thrills and plenty of sport to be had and plenty of money to be made, wrangling wild horses by airplane. Jerry Barker, Charlie Kendall, and I are going after them all. We are planning another trip to Nevada to wrangle wild horses by airplane.

END.

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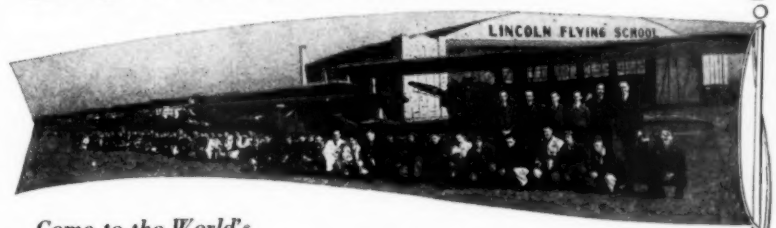

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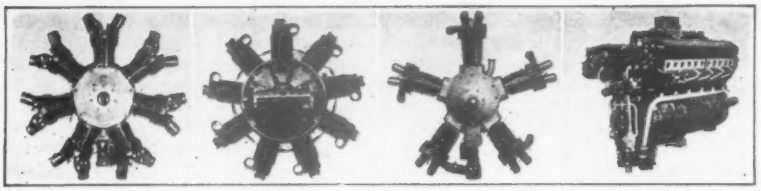

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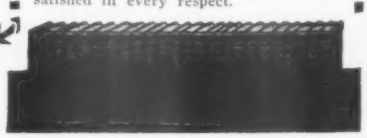
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